RECOMMENDATIONS FOR THE SEISMIC ANALYSIS OF MULTISTORIED BUILDING WITH FLOATING COLUMN

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***Abstract:*-Modern multi-storey buildings are constructed with irregularities such as soft storey, vertical or plan irregularity, floating column and heavy loads. These kind of designs have turned into an exceptionally normal development practice in metropolitan India. It is seen that the greater part of the RC structures with such inconsistencies built are profoundly unwanted in seismically dynamic regions from the aftereffects of past quake examines. These impacts happened because of different reasons, like non-uniform circulation of mass, firmness and strength. This review clarifies the seismic examination of a multi-story working with drifting segment developed in eismically dynamic regions noticing its responses to the outer sidelong powers applied on the structure in different seismic zones utilizing the product ETABS. In this way featuring the elective measures including in ad libbing the non-uniform dissemination in the unpredictable structure, for example, multi-celebrated structure with gliding section, and suggested the more secure plan of such structure in seismically dynamic regions considering the outcomes saw from story floats, story removals, when contrasted with Response Spectrum technique shows best outcomes.**

1. INTRODUCTION

India is an emerging nation, where urbanization is at the quicker rate in the nation including embracing the techniques and kind of developing structures which is under tremendous advancement in the beyond couple of many years. As a piece of urbanization multi-story structures with engineering intricacies are developed. These intricacies are only delicate story, coasting segment, weighty burden, the decrease in firmness, and so on Presently a day's the majority of the metropolitan multi-story structures have open first story as an unavoidable component. Convenience of stopping or gathering halls is the essential utilization of these open first story in the multi-story structures built. Yet, Conventional Civil Engineering structures are planned based on strength and solidness standards. Normally the ground story is kept free with practically no developments, aside from the segments which move the structure weight to the ground.This proposition embrace the multi-story building with an engineering intricacy i.E. The intricacy of a multi-story working with "Gliding segment" and the conduct of the structure in better seismic zones is noticed and thought about a couple of ideas.

1.1 FLOATING COLUMN

"A column is supposed to be a vertical member starting from basis level and shifting the burden to the floor, and the term

"Floating Column" is also a vertical detail which at its lower degree rests on a beam that's a horizontal member".

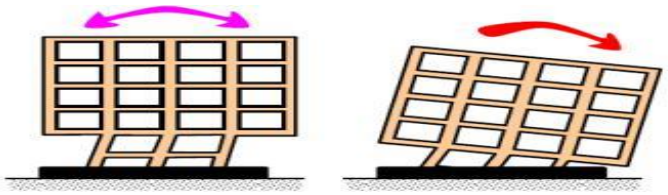

Fig a: Building with Floating Column

A typical type of intermittence in load course in second casings emerges with a coasting sections, i.E., when a segment coming from top of the building is ceased at a lower level, by and large on the ground story. In such occasions, loads from the overhanging segments take a diversion and excursion to the closest section this is relentless until the motivation. This outcomes in expanded interest at the segments in the ground story and may thought process disappointment of these sections.

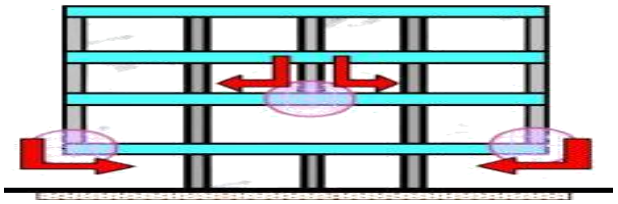

Fig b: Buildings with floating columns: Overloading of columns in ground storey cause failure of buildings with floating columns during strong earthquake shaking.

Generally these high-up push and compositional confounded homes showed a least useful conduct all through past earth quakes. By and large the behavior of a developing all through quakes depends upon specially on its standard structure, length Furthermore, calculation, notwithstanding the how earthquake powers are conveyed to the floor by the sections.Structures with segments that hang or drift on radiates at a middle story and do presently not cross all the way to the establishment, have discontinuities in the heap move heading. There are a couple of homes with vertical difficulties actually like the hotel homes with a couple of story more extensive than the unwinding cause an amazing jump in quake powers at the degree of irregularity.

There are many undertakings in India in which skimming section are now followed, extraordinarily over the ground floor, wherein the exchange supports are utilized, all together that more open region is to be had on the floor ground, and those open regions might be needed for gathering hallway or stopping reason. The segment is an engaged burden at the pillar which helps it on the present situation. Thus the frameworks previously made with those styles of spasmodic givers are imperiled in seismic locales. In this way the coasting section is utilized for the rationale of compositional view and arrangement conditions. It very well might be investigated with the guide of the utilization of STAAD Pro, ETABS and SAP2000. In the look at the conduct or the multi-story structures with skimming segments at higher seismic zones the utilization of ETABS are demonstrated and examined.

1.2 EARTH QUAKE RESISTANT DESIGN

Generally these buildings with floating columns are usually designed for gravity loads and are safe under gravity masses however aren't designed for earthquake hundreds. So those homes are risky in seismic defenseless regions. Thus this analyze pursuits to make acknowledgment roughly those issues in tremor safe design of multi-storeyed homes with drifting section.

There are 4 excellencies of Earthquake Resistant Design, and the qualities of the developing resemble the components for modelers and format specialists to work with to make the quake safe plan of a structure, in particular seismic underlying arrangement, horizontal solidness, parallel strength and flexibility. Notwithstanding various parts like shape, feel, capacity and extravagance of building, sidelong firmness, parallel force and pliability of homes might be guaranteed via rigorously following most seismic plan codes like IS 1893-2002(Part-1). However, fantastic seismic underlying arrangement might be guaranteed through after cognizant building abilities that achieve exact primary conduct. The ideals are finished through inputs provided in any regard levels of the advancement likely in its Planning, Design, Construction, and Maintenance.

Fig c: Four Virtues of Earthquake-Resistant Buildings control earthquake performance of buildings

Fig c, Explains the Stiffness, Strength and Ductility straightforwardly affect load disfigurement conduct of homes, while Seismic Structural Configuration impacts these 3 ethics by implication and Energy Dissipation Capacity is a standard consequence of the multitude of four ideals of structures.

Dissimilar to any remaining stacking results like breeze hundreds, wave loads(excepting tidal wave loads), impact hundreds, snow masses, forced (live) loads and pointless burdens, tremor shaking is the greatest extreme, as it forces relocation underneath the structure, that is time different and this in flip outcomes the horizontal twisting inside the structure among base and upper heights.

In any multi-story shape firmly dispersed sections fundamentally dependent on the arrangement of upper ground surface are not appropriate inside the lessening flooring, as a way of avoiding that issue gliding segment thought has appeared. Such structure are routinely known as open ground story structures or expanding on braces and this open ground story framework is being embraced because of the benefit of open region to meet the low in cost and design needs. In any case, those brace floor utilized is the greatest genuinely harmed or imploded structures for the span of a quake. The revel in of different worldwide areas with such sort of homes sooner or later of quakes continually seriously debilitate production of a developing with a smooth ground due to the negative and obliterating execution. Subsequently this story is alluded to as a powerless story since this story firmness is lower assess to above story, and without issues imploded for the length of tremors. In this way the firmness is identified with as far as possible states which guarantees that the underlying uprooting stays with as far as possible. If there should arise an occurrence of quake powers the call for will be intended for malleability. Pliability is an essential quality of a design that need to answer to the vigorous floor movements. Previously, various fundamental seismic tremors have uncovered the weaknesses in homes,Which had set off them to damage or self-destruct. Contrasted with the unusual formed homes standard molded structures perform better all through quakes and these underlying anomalies cause non-uniform burden dispersion in various individuals from a structure. Sometimes a portion of the sections are ended at sure ground surface and in certain examples painstakingly separated segments based at the design of higher deck, aren't proper inside the lessening flooring and thus the skimming segment are brought as the modeler needs for the aesthetic view of the structure, It is expressed in the Arrangement about gliding segments as maximum of the homes in India are overlaying the most practical region on a plot within the to be had local laws. Since balconies are no longer included in ground space record (FSI), so the homes have galleries overhanging in the popular narratives past the section impression districts at the floor storey, with overhangs up to 1.2 m to 1.5 m in arrangement are normally furnished on each feature of the structure. In such occurrences, these gliding segments are provided along the overhanging border of the structure. To win over this issue switch braces are conveyed as a typical method with the end goal that a few segments are ended from the higher story's and these coasting segments which may be acquired those cases are upheld on radiates which may be called as switch supports. Subsequently the coasting segment go about as a point load on the bar and that bar moves the weight to the segments underneath it yet in appropriate section situation the end degree isn't worked with care to such an extent that causing disappointment and thus this kind of segments can't be built nearly and without trouble did. It has been seen that the homes with open stories for stopping or various capacities has articulated a disturbing measure of mischief all through past quakes.

Essentially every one of the powers that follow up on a building are thought about in over the top vertical push homes, which remembers its own load for expansion to the dirt bearing capacity. There additionally are some outer powers

follow up on the building added substances as pillar, section and support which ought to be exact adequate to check these powers viably thus the dirt to pass the weight effectively to the establishment. Be that as it may, because of the absence of ability for quake safe plan of structures in our US of america, the greater part of the current structures are in danger of future seismic tremors. So data the significance for the tremor safe design. The Indian seismic code IS 1893 (Part1): 2002 is seen up. This arrangement orders a smooth story as "one in which the horizontal firmness is significantly less than 70 level of that during the story above or much less than the vast majority of the normal sidelong solidness of the three stories above. However, we likewise saw that conduct of shape all through seismic tremor development relies upon appropriation of weight, firmness and strength in both level and planes of building. With the end goal that the development of substantial shear dividers is taken on as a procedure of decrease in quake powers at the developing to such an extent that the seismic reaction of structures is also advanced. Thus the arrangement of shear divider in developing to reap rigidity not really settled powerful and great worth. At the point when structures are tall, beam and segment sizes are very weighty and steel required is enormous. Subsequently, foundational layout of buildings for seismic stacking is commonly concerned with structural wellbeing all through head Earthquakes in high-up push structures and it's far extremely fundamental to guarantee alright sidelong solidness to oppose parallel masses which incorporates quakes. We can view that a large portion of the energy developed sooner or later of tremors is dispersed by utilizing the sections of the delicate story of the structure and furthermore with stacked more close by the drifting segments provided close by the building. What's more, introducing malleability to the shape expands the capacity to go through mutilation or misshapening with no mischief or disappointment of the factor of the working in the dissipation of energy, to such an extent that huge is the potential in the deformation of the shape without disintegrate better is the subsequent eight pliability and strength dissemination of the design. In this manner the exceptional worries inside the assessment and design. While working out for the multi-storeyed structure physically a few blunders are happened ingesting additional time thus utilization of programming expansions in priority for the estimation.

As of late there are huge number of multi-storeyed structures followed coasting sections to get additional open space for stopping or gathering anterooms Collapsed and have been altogether severed in quake passed. For the most part a parallel burden in light of tremor follows up on a developing depends upon on seismic zones, assortments of soil, type of creation and plan calculation and this shifting greatness relies upon the profundity of tallness ground speed increase. Though sections that stream or stick on radiates at a transitional story and don't visit the dream have discontinuities inside the heap move heading, are the drifting segment homes. The Floating section sway on construction can be clarified as the shortfall of the dividers deteriorates the effect of tremor load and for the most part can be decreased through infill dividers. In well known, firmness of infill divider isn't considered to look up to the gravity stacks anyway it contributes sizable capacity during seismic tremor thus changes are dismissed inside the unique conduct of the design. However, in developing nations like India the structures are regularly built with workmanship in filled allotments have shown an incredible generally execution inside the past tremors regardless of the way that they weren't intended for seismic response and it is additionally found that these workmanship in filled dividers are uniform in design. Thus the suitable decision in setup of the underlying machine exceptionally depends upon with the genuine seismic exhibition of the structure. So these abnormalities like gliding section embraced inside the multi-story building are conveyed through changing over the part houses which remember the substantial burdens for the zenith, open first story to the story thought about. Hence, when such structures situated inside the better seismic zone the results, for example, story floats, shear powers in story underneath consideration and redirection of shafts are examined to comprehend the skimming segment effect of multi-story building, prompting the requesting circumstances for the primary architects.

1.3 RESPONSE SPECTRUM METHOD

Usual seismic design of structures is carried out the usage of the maximum pressure caused in the structure due to earthquake shaking. Force can be described in methods: (i) mass, m instances acceleration, a that is representing inertia pressure or (ii) stiffness, k instances displacement, x that is representing elastic force i.E.,

$$F = ma \text{ (or) } F = kx$$

Further, at the point when you consider that outright limit of such response is valuable in design, a diagram of the most extreme reaction is created for a range of SDOF structures with extraordinary natural periods, T and the equivalent damping underneath the indistinguishable seismic tremor ground development. This diagram is known as the Response Spectrum of the interesting seismic tremor floor development. One such response range relating to the speed increase of the structure, called the speed increase reaction range for five% damping under the activity of 1940 Imperial Valley seismic tremor floor development (El Centro factor).

In genuine homes, it's undeniably less hard to figure the mass of the structure this is incredible during quake shaking, called seismic mass (indistinguishable from seismic weight separated by utilizing speed increase as a result of gravity g), than to evaluate standard solidness. Hence, when the natural term identified with every method of wavering is normal, the relating seismic horizontal strain is procured by utilizing duplicating the speed increase reaction range cost (from the speed increase response range) with the mass related to each method of swaying. In the plan of homes, seismic plan codes give a plan reaction range and the comparing pressure got is known as the plan seismic sidelong power of the structure or the format seismic base shear of the structure. The innovation of speed increase response range and an other of edge of reference of deformity together have worked with changing the moving base difficulty of tremor shaking of homes into an immovable base difficulty. Configuration codes utilize a Design Acceleration Response Spectrum, which is

gotten from the Acceleration Response Spectrum of numerous singular ground movements. Plan Acceleration Response Spectrum is explicit for every space inside the usa, for the explanation that seismic wave developments are exceptional at unmistakable spots in the usa. In any case, it'd be dreary in case fashioners are needed to accomplish this format range with the guide of themselves for the design of man or lady homes in a natural. Thus, plan codes endorse that the equivalent Design Acceleration Response Spectrum be utilized throughout the US of america. This Design Acceleration Response Spectrum recommended by codes is a range embraced to be utilized inside the format of straightforward, typical and common structures. For the format of uncommon homes (e.G., tall structures), a Design Acceleration Response Spectrum ought to be shown up at exceptional to the site where the extraordinary structure is being developed.

2. LITERATURE OF REVIEW

2.1 INTRODUCTION

In the present study, the research articles and journals that are studied for understanding of the work to be carried out are discussed and these papers are presented as per the reference of this study in this chapter.

2.2 PREVIOUS LITERATURE

Sabari. S, Mr. Praveen J.V [1],(2014), this paper refers to the "**SEISMIC ANALYSIS OF MULTI-STOREY BUILDING WITH FLOATING COLUMN**" In which the FEM analysis is achieved for 2D and 3-d multi-storey frames with and without floating columns studying the responses of the shape with one-of-a-kind seismic excitations where the RC frames are of with specific stiffness on floor smart and height of the building, that are considered in the evaluation retaining PGA and time length factors as constants having unique frequency and highlighting with alternative measures related to stiffness balance to reduce the irregularity in the first and storey above that's introduced by the floating columns. The time history evaluation is carried out by way of considering the entire gadget of frames of the building to Bhuj earthquake excitations, and are provided to evaluate the outcomes acquired from the evaluation of all types of frames the use of the SAP2000 software program.

This paper consequently concluded as outcomes obtained the usage of present finite detail code for the static and free vibration are confirmed and the dynamic evaluation of frame is studied by varying column size dimension and is concluded that by means of growing the column length the maximum displacement and inter storey drift values are reducing.

Sreekanth Gandla Nanabala, Pradeep Kumar Ramancharla, Arunakanthi E[2],(2014), This paper refers the intensities along with floor motions of the beyond earthquakes. Such that the observe highlights whether the shape with floating columns are secure or risky in seismically lively regions and additionally examine the shape is most economical or uneconomical. This paper research the G+five storey constructing with all columns that may be a ordinary building and the alternative constructing without edge columns in the floor floor that could be a floating column building's behaviour when excited to the lateral masses. After the evaluation of the homes it is observed that the G+five without aspect columns is not safe in seismic quarter because the lateral displacement in a floating column constructing is higher than a everyday constructing, so the floating column building is hazardous in seismic regions. When the lateral stiffness of both the buildings are as compared then it's far observed that the constructing with floating columns will suffer severe tender storey impact where on the opposite facet the everyday constructing is loose from gentle storey effect completely. In the analysis finished among the buildings the amount of metal and concrete are 40% and forty two% more in floating column building than the normal constructing. Hence it is concluded that the floating column constructing is dangerous and uneconomical and no longer prime for creation whilst compared with the everyday column constructing.

Prerna Nautiyal, Saleem Akhtara And Geeta Batham[4],(2014) titled as"**SEISMIC RESPONSE EVALUATION OF RC FRAME BUILDING WITH FLOATING COLUMN CONSIDERING DIFFERENT SOIL CONDITIONS**". This paper investigated the impact of the floating column underneath earthquake excitation for one-of-a-kind soil situations and a linear dynamic analysis is carried out for the 2D frame of the multi-storey building with and without floating column to obtain the response of the frame for safer and low-cost design of the structure beneath such excitations.

This paper observe the effect of a floating column beneath earthquake excitation for numerous soil situations wherein for the cause of analysis two one of a kind models are taken into consideration. They are G+3 and G+five second resisting frames. The result tested are the response spectrum evaluation for varying soil conditions and the magnification factor that is evaluated for base shear and moments for both G+3 and G+5 models including the outside and interior columns and beams. From the effects consequently received are concluded as, the base shear discovered for medium soil are higher than the difficult soil in both the cases because the height of the constructing will increase the version inside the base shear from medium to difficult soil condition decreases, and further it could be concluded that, because the top of the building increases the variation of most moments receives decreased for extraordinary soil situations. Hence from the effects of the reaction spectrum analysis acquired for each the moment resistance frames shows that the vicinity of floating columns at corners as of modelled within the cases considered are extra crucial than others inside the present take a look at.

Prof.M.R.Wakchaure, Anantwad Shirish[7],(2012), titled as " **STUDY OF PLAN IRREGULARITY ON HIGH RISE STRUCTURES**". This study targets at description of plan irregularities by using analytical approach at some stage in seismic occasions. Analyses had been performed to estimate the seismic performance of excessive rise homes and the results of structural irregularities in stiffness, strength, mass

and aggregate of these factors are going to be taken into consideration. These irregularities are modelled in ETABS software program. The two styles of models developed are specifically power and serviceability fashions, studying the deformations, floor responses and displacements, natural frequencies and time periods. From the analysis consequences of both the systems which are T and oval formed that are modelled and analysed as in line with IS1893-2002(component-1). In this evaluation the models are hired with the structural framing, loading styles and materials which can be commonly not used in the layout of traditional seismic resisting structures consisting of shear partitions. From this have a look at it's far proved that the dual structures taken into consideration to take a look at are offered with greater within your budget production in conjunction with the enduring architectural image.

Dr. P. S. Pajgade[12],(2014), entitled as "**SEISMIC ANALYSIS OF RCC BUILDING WITH AND WITHOUT SHEAR WALL**". This take a look at especially highlights the solution for shear wall location and effectiveness in multi-storied constructing with the help of 4 distinctive fashions. Where modal one is naked body structural gadget and the opposite three are dual type structures and these are analysed for the seismic zones from II to V. The consequences received are concluded by considering the elements like lateral displacements and tale drifts and also general value required for ground ground calculated for replacing column with shear partitions. It is concluded as the constructing with short span shear walls at corner is extra low in cost while as compared with other fashions and as a result it is able to be concluded that big measurement shear wall isn't powerful and additionally concluded that the shear wall is within your means and effective in excessive-upward push constructing, and it's miles located that alternate in the function of shear wall appeal to forces and hence the wall ought to be supplied in proper function and supplying the shear walls at adequate locations considerably reduces the displacements because of earthquake.

Rajesh Harugoppa[13],(2014), entitled as "**EFFECT OF FLOATING COLUMNS ON SEISMIC FORCES OF RC SUPPORTING FLEXURAL MEMBERS IN A TYPICAL OMRF WITH AND WITHOUT INFILL MASONARY**". This paper mainly aims at developing attention within the construction of earthquake resistant layout of multi-storey homes by qualifying the vulnerability in terms of the demands of shear pressure and bending moment in decided on contributors of a standard constructing. In this look at the models had been selected for the research of the systems to fulfil the necessities which include to increase the ground space index and also heading off carefully spaced columns inside the floor storey to get massive uninterrupted area which is required for the motion of humans or cars. Here on this have a look at a G+four building with regular moment resisting body in orthogonal guidelines which had been supported on cantilever projections of the beams in first floors and switch girders delivered for supporting floating columns, have been decided on and analysed the usage of the STAAD Pro software program. The linear method of analysis is chosen to examine the models and exhibit the outcomes, and the effects are analysed from seismic weights of flooring, base shear and vertical distribution. Hence the consequences received are firstly, while a constructing is designed for gravity loads and an earthquake such that the floating columns supported on cantilever projections, such that shear pressure in cantilever spans are high relatively and have a excessive tendency to fail below shear that's surprising and brittle. Secondly, for the floating columns supported on transfer girders suggests shear pressure, span sagging moment, aid hogging second are substantially high with increase in span of transfer girders and additionally that modelling with struts for the infill partitions offers extra impact in shear force.

Wakchaure M.R, Ped S.P[14],(2012), referre **The QUAKE ANALYSIS OF HIGH RISE BUILDING WITH AND WITHOUT INFILLED WALLS**". This take a look at deals with effect of masonry partitions on excessive upward push homes, when a time history evaluation is carried out to the fashions and are analysed using the software program ETABS. The outcomes are received by using considering the base shear, storey displacements, storey drifts, and additionally it's miles discovered that how the infill partitions reduce displacements, time periods and increases the bottom shear. Thus the conclusions received from the consequences received are, that the structural infill wall have very important impact on structural behaviour beneath earthquake effect. Such that the displacements and relative tale displacements are laid low with the structural irregularities on the structural capacity underneath earthquake effect, where the infill walls are very crucial components to impact on structural behaviour of the constructing. Thus the from base shear found, it's far received that the base shear is improved because of infill partitions, and from the displacements located, it is acquired that the pinnacle tale displacements are reduced with the infill walls, whereas from the story drifts determined, it is acquired as the story drifts are confined to the permissible limits in the model with infilled walls.

Mulgund G.V, Dr. Kulkarini A.B[15],(2011), entitled as concluded as in line with IS-1893(2002) code book. Thus the outcomes acquired whilst analysed using the software program FEMA-356 2000, are as follows. The advent of infill panels within the RC frames reduces the time period of naked frames and additionally enhances the stiffness of the structure. The lateral displacements are drastically decreased at the creation of infill panels inside the RC frame. When a base shear is observed, then the performance assessment the usage of first mode lateral load sample resulted in better base shear than that of in the codal provisions. Thus it is able to be concluded that, the calculation of earthquake forces by way of treating RC frames as everyday frames without regards to infill leads to underestimation of base shear and additionally we acquired from effects that the overall performance of complete masonry infill panels are extensively superior to that of bare frames and soft storey frames. This take a look at also demonstrates the usage of nonlinear displacement based totally analysis methods for predicting overall performance based seismic

assessment.

J. Ushasree, Syed Afzal Basha, K. Sowjanya[16],(2014), entitled as "**COMPARISION OF CONVENTIONAL STRUCTURAL ANALYSIS AND LINEAR STATIC ANALYSIS USING ETABS**". The most important goal of this paper is to analyse and layout single bay unmarried storey the usage of the ETABS software program. In this paper the preliminary design and evaluation are manually calculated after which proven with effects obtained from software, and the stairs followed in the layout are from engineering structure and structural layout with the main goal of structural layout is to devise a structure, which meets the primary requirements of structural layout and it's far discovered that the consequences acquired are proved to be accurate and it's far concluded that the have a look at reveals the necessity of appearing nonlinear static analysis becomes important with growing slenderness whilst the each additional floor creates a vast load upon the columns. Moments and shear in helping beam are better in sequential evaluation which should be taken into consideration in the course of guide or CAD for keeping off cracking.25**S.**

Zubair Ahmed, K.V.Ramana, Ramancharla Pradeep Kumar[17], entitled as "**SEISMIC RESPONSE OF RC FRAME STRUCTURE WITH SOFT STOREY**". In this have a look at there are 3 types of fashions are modelled and analysed and the fashions are, a model with out infill wall i.E. Bare frame, a model with open backside storey, and model with metal bracing gadget at backside storey. In this paper the dynamic analysis of the building models are analysed using the ETABS software. The outcomes are evaluated in phrases of Storey Drifts, Lateral Displacements, Lateral Forces, Storey Stiffness, Base shear, Time length, Torsion. It is concluded that metal braced device notably contributes to the structural stiffness and decreases the most inter tale float, lateral displacement of R.C.C building. When the deflection is determined, the bare frame have very massive deflection whilst as compared with the alternative cases. It is likewise concluded that the metal bracing system inside the version influences the seismic behaviour of the model to a huge volume growing the stiffness of the structure. It is also discovered that the X-form of metallic bracing system at bottom storey has less torsion effect.

3. OBJECTIVE

3.1 INTRODUCTION

In this present project, the following aspects are attempted to study.

1) Modeling of the multi-storey constructing with and without floating column the use of ETABS.

2) Comparative observe is done among the multi-storey building with and without floating column in extraordinary zones, whilst the floating column are gift on the identical ground and different place within the building.

3) Comparative study on variations in the structural reaction in the structure due to seismic ex citation is also completed.

4) The building with floating column are generally tend to fail at seismic excitations, for this reason the pointers for the earthquake resistant layout of the considered buildings are modeled and analyzed.

5) The main objective of the look at is to offer a inexpensive and secure design of a building with floating column at seismic zones with recommending some layout guidelines as there is no distinctive provision or magnification element supplied in I.S codes for this type of irregularities.

4. METHODOLOGY, MODELLING AND ANALYSIS OF FRAMES

4.1 INTRODUCTION

This chapter explains the methodology adopted in the modeling and analysis of the frames in the study.

- The modelling of the buildings are done using ETABS software,
  following the codes IS 456-2000 and IS 1893-2002(part1),
- As per IS 1893-2002, "clause 6.2 assumptions" for "Earthquake Resistant design of structures" are followed, and as per clause 6.3.1.2 the load combinations are accounted, i.e.

a) 1.5(DL±IL)
b) 1.2(DL±IL±EL)
c) 1.5(DL±EL)
d) 0.9DL±1.5EL

- Shear walls are designed as per IS 13920-1993 Clause 9.1.2 and their thickness is not less than 150mm.
- As per IS 1893-2002, the moment resisting frames are designed independently to resist at least 25% of the design base shear..
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4.2 THE MODELLING DETAILS OF THE BUILDINGS ARE AS DISCUSSED BELOW.

- For evaluation and have a look at reason there are few models evolved on this have a look at such that a multi-storey constructing this is Stilt+G+four constructing is taken into consideration and modelled into two sorts in particular.
- They are a multi-storey constructing with out floating column that may be a regular constructing and the alternative kind is multi-storey building with floating columns at special positions in it.
- Among those two varieties of models, the multi-storey building with out floating column is considered consistent comparing it with the fashions evolved as multi-storey building with floating column where these floating column are present at unique portions of the constructing analysing it at distinct zones as quarter 5 to area 2 as according to codal provisions.
- And the analytical models of the constructing

encompass all the factor that affect the mass, electricity, stiffness and deformability of the structure.

- ETABS is a standalone finite element based totally structural application for the evaluation and layout of civil systems and which is a fully incorporated program that permits version advent, modification, execution of analysis, design optimization, and outcomes review from within a single interface and for that reason used for the analysis of all structural systems by using linear static approach for zones II and V.
- Hence the results are tabulated by using focusing the parameters like lateral displacements, base shear and story flow.
- From the "Response Spectrum Analysis" while as compared indicates the fine outcomes. This is explained as, The earthquake reaction spectrum evaluation is the most popular method inside the seismic evaluation of the structures.
- There are computational gain for prediction of displacements and member forces within the structural systems the usage of the response spectrum method.
- This technique involves within the calculation of the maximum values of the displacements and member forces in every mode of vibrating using smooth layout spectra which are the average of numerous earthquake motions.
- This paper research with the response spectrum analysis of the multi-storey building with floating column at special positions of the building. As in keeping with the code IS 1893-2002(element 1) the reaction spectrum analysis of multi-storey constructing is summarized.

The models details are,

Model 1: Stilt+G+4 building without floating column i.e. normal building analysed from zone 5 to zone 2,
Model 2: Stilt+G+4 building with floating column at Edge column position, analysed from zone 5 to zone 2,
Model 3: Stilt+G+4 building with floating column at Centre portion, analysed from zone 5 to zone 2,
Model 4: Stilt+G+4 building with floating column at parallel positions, analysed from zone 5 to zone 2,
Model 5: Stilt+G+4 building with floating column with recommendations, analysed from zone 5 to zone 2

Table (1) :Multi-Storey Building Geometrical Dimensions

Member dimensions		
slab	Thickness	120mm
Beams	Normal building	230x480mm
	Floating column building	Varies between 230x480mm to 230x600mm
columns	Normal building	400x400mm
	Floating column building	Varies between 400x400mm to 600x600mm
Brick infill wall thickness	Exterior wall	250mm
	Interior wall	150mm
Shear wall thickness		250mm
Loads		
Unit weight of concrete		25kN/m^2
Unit weight of brick infill		20kN/m^2
Floor loads	Live load	3.5
	Dead load	1
Roof loads	Live load	1.5
	Dead load	1
Grade of rebar		
Beams		Fe 415
Columns		Fe 415

Table (2) : Parameters Of Earthquake Loads Considered For The Study

Parameters		**values**
Seismic zone factor	Zone 5	0.36
	Zone 4	0.24
	Zone 3	0.16
	Zone 2	0.10
Importance factor		1.0
Response reduction factor		5.0
Percentage of damping		5%

5. RESULTS AND DISCUSSIONS

A comparative look at and analysis is performed between a everyday column constructing this is the constructing with all regular columns and different structural and non-structural members in it and on the other hand a floating column building at diverse zones as in keeping with the specs in IS-1893(2002)part 1. A detail study is executed on the floating column building to locate out the versions in the structural response of the building with floating columns at "parallel positions, at one edge column function and at the centre portion", found from the parameters like maximum displacements in the building at each ground, story drifts and the consequences acquired are past the deformation limits.

Then one of these floating column constructing generally tend to fail in intense earthquake zones, for that reason a few suggestions are accomplished to examine the building response in that case. The suggestions observed

are shear walls, infill partitions, Steel bracings and the designed frame is a second resisting body for the evaluation of the constructing in these situations. Hence the results are mentioned and are as proven under.

In the analysis of the models with tips, the following are the assumptions made. In attention of shear walls, following the provisions inside the code IS 1893-2002(part 1), and in the attention of infill partitions, the masonry infill partitions are considered. As, it is located that the masonry infill partitions generally tend to reduce the displacements, time durations while as compared with the opposite type. And additionally that, the steel bracings are taken into consideration in the study, through staring at that metallic bracings are extra efficient compared to the concrete bracings in resisting the forces exerting on it, and the "x" shape are used as this shape of bracing machine proves to have less torsion impact on the structure while external forces are exerted on it. Thus, from those concerns, the fashions are analysed as mentioned under,

Model 1: Stilt+G+4 building without floating column i.e. normal building analysed from zone 5 to zone 2

In this model, Normal building body is designed and analysed thinking about the parameters like most displacements and tale drifts in X and Y guidelines, Column P-M-M interaction rations are determined and reaction spectrum evaluation is also discovered. Thus, the outcomes received are mentioned underneath. The figures proven underneath are plan and elevation view of the normal building.

Table 3:Maximum displacements of the normal building at zone 5 to zone2

Story	Elevation	Location	ZONE 5	ZONE 4	ZONE 3	ZONE 2
Base	0	Top	0	0	0	0
Story1	1.28	Top	0.6	0.4	0.3	0.2
Story2	4.28	Top	4.9	3	2.2	1.4
Story3	7.28	Top	9.5	5.8	4.2	2.6
Story4	10.28	Top	13.5	8.2	6	3.7
Story5	13.28	Top	16.6	10.2	7.4	4.6
Story6	16.28	Top	18.6	11.5	8.3	5.2
Story7	19.28	Top	19.6	12.2	8.7	5.5

Fig 3: Maximum displacements of the normal building at zone 5 to zone 2

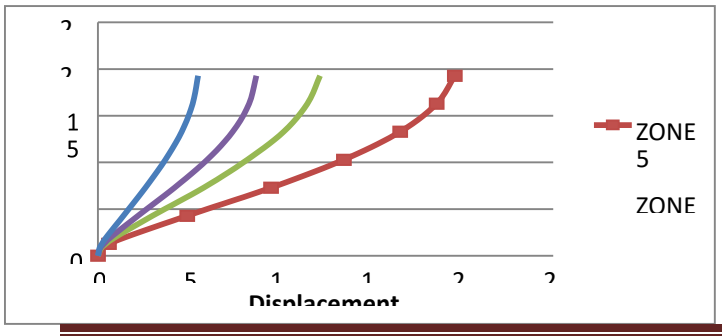
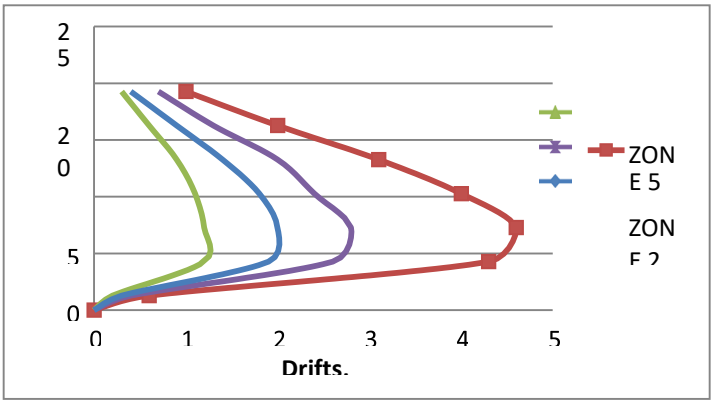


Fig 4: Maximum Storey drifts of the normal building at zone 5 to zone 2



Model 2: Stilt+G+4 building with floating column at Edge column position, from zone 5 to zone 2,

In this version, the floating column at a Edge column role is designed and analysed with the aid of thinking about the parameters like maximum displacements and story drifts, Column P-M-M interaction ratios. The consequences obtained are mentioned below.

Table 5: Maximum displacements of the floating column at Edge column position from zone 5 to 2

Story	Elevation	Location	ZONE 5	ZONE 4	ZONE 3	ZONE 2
Base	0	Top	0	0	0	0
Story1	1.28	Top	1.4	0.9	0.6	0.4
Story2	4.28	Top	7	4.7	3.2	2
Story3	7.28	Top	11.7	7.7	5.2	3.2
Story4	10.28	Top	15.5	10.1	6.7	4.2
Story5	13.28	Top	18.4	11.9	7.9	5
Story6	16.28	Top	20.3	13.1	8.7	5.5
Story7	19.28	Top	21.2	13.7	9.1	5.7

Table 4: Maximum Story Drifts of the floating column at Edge column position from zone 5 to zone 2

Story	Elevation	Location	ZONE 5	ZONE 4	ZONE 3	ZONE 2
Base	0	Top	0	0	0	0
Story1	1.28	Top	1.4	0.9	0.6	0.4
Story2	4.28	Top	5.6	3.8	2.6	1.6
Story3	7.28	Top	4.7	3	2	1.2
Story4	10.28	Top	3.8	2.4	1.5	1
Story5	13.28	Top	2.9	1.8	1.2	0.8

Story6	16.28	Top	1.9	1.2	0.8	0.5
Story7	19.28	Top	0.9	0.6	0.4	0.2

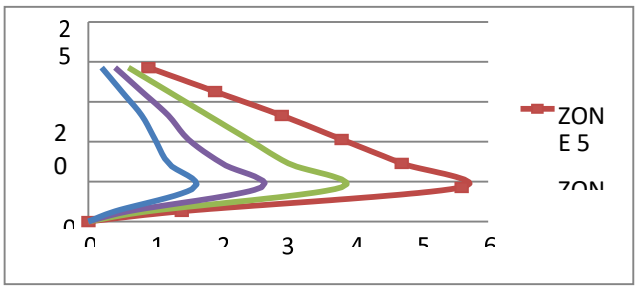


Fig4: Maximum Story Drifts of the floating column at Edge column position from zone 5 to zone 2

In this model if we evaluate the maximum displacements and story drifts received for the everyday constructing frame, the floating column building frame shows higher displacements and tale drifts, for this reason looking at the consequences we are able to understand that the presence of floating column in any Edge column role in the building can deliver the better values of forces performing on it, ensuing in the increase of building failure situation in better seismic areas, in which higher seismic excitations can be acquired.

Model 3: Stilt+G+4 building with floating column at Centre portion, from zone 5 to zone 2,

In this version, the floating column is gift on the centre element of the frame modelled and analysed. The effects acquired are with the aid of thinking about the parameters like most displacements and story drifts of the shape modelled, and the consequences obtained are discussed as under.

Table 7: Maximum displacements of the floating column at Centre column position from zone 5 to zone 2

Story	Elevation	Location	ZONE 5	ZONE 4	ZONE 3	ZONE 2
Base	0	Top	0	0	0	0
Story1	1.28	Top	1	0.7	0.4	0.3
Story2	4.28	Top	5.4	3.6	2.4	1.5
Story3	7.28	Top	10.1	6.7	4.4	2.8
Story4	10.28	Top	13.8	9.2	6	3.8
Story5	13.28	Top	16.8	11.2	7.3	4.7
Story6	16.28	Top	18.9	12.6	8.2	5.3
Story7	19.28	Top	20	13.3	8.6	5.6

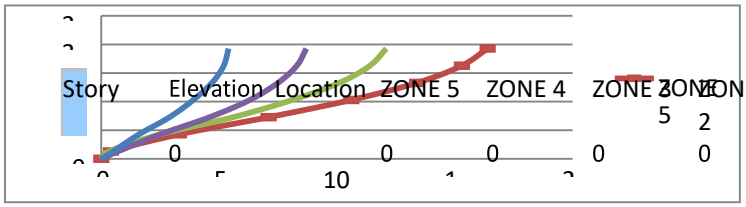
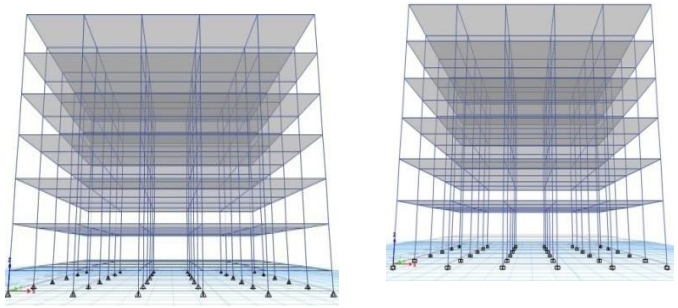


Fig 11: Maximum displacements of the floating column at

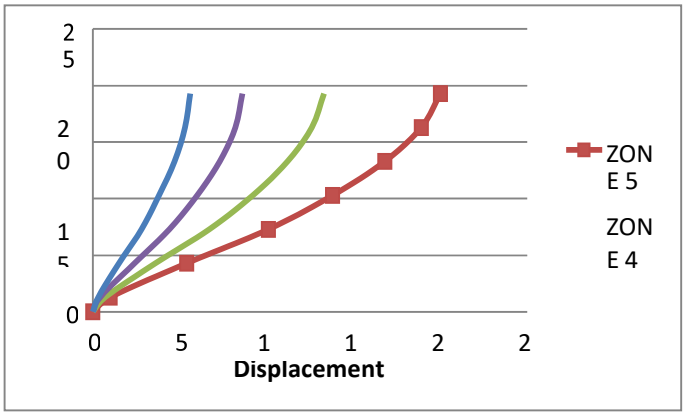
Table 8: Maximum Story Drifts of the floating column at Centre column position from zone 5 to 2

Story	Elevation	Location	ZONE 5	ZONE 4	ZONE 3	ZONE 2
Base	0	Top	0	0	0	0
Story1	1.28	Top	1	0.7	0.4	0.3
Story2	4.28	Top	4.4	2.9	2	1.2
Story3	7.28	Top	4.7	3.1	2	1.3
Story4	10.28	Top	3.7	2.5	1.6	1
Story5	13.28	Top	3	2	1.3	0.9
Story6	16.28	Top	2.1	1.4	0.9	0.6
Story7	19.28	Top	1.1	0.7	0.4	0.3

Fig 5: Maximum Story Drifts of the floating column at Centre



column position from zone 5 to zone 2



Model 4: Stilt+G+4 building with floating column at Parallel positions, from zone 5 to zone 2,

In this model, the floating column are gift at the Parallel positions of the body and the outcomes are obtained from the parameters taken into consideration from the analysis which include maximum displacements and story drifts. Thus, the effects located are as discussed below.

Story	Elevation	Location	ZONE 5	ZONE 4	ZONE 3	ZONE 2
Base	0	Top	0	0	0	0
Story1	1.28	Top	2.4	1.6	1.1	0.6
Story2	4.28	Top	8.7	5.8	4.1	2.4
Story3	7.28	Top	0.1	0.1	1.16	0.1
Story4	10.28	Top	0.1	0	-0.03	0
Story5	13.28	Top	0.1	0.1	0	0
Story6	16.28	Top	0	0	0	0
Story7	19.28	Top	0.1	0	0	0

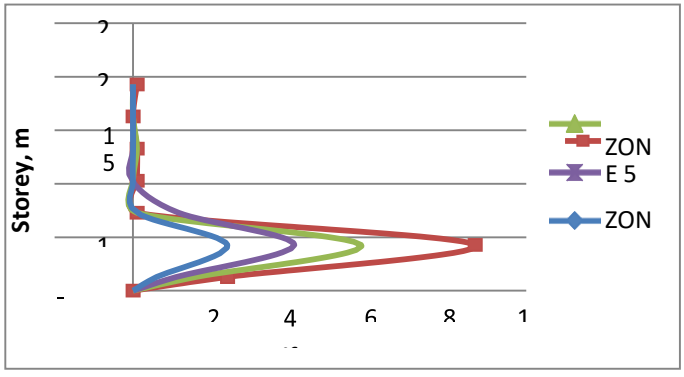
Model 5: Stilt+G+4 building with floating column with recommendations, such as Shear walls, Infill walls and Steel Bracing systems,

A) Stilt+G+4 building with floating column at the Edge column position with recommendations considering Shear walls,

In this model, the frame designed with floating columns at the Edge column role are modelled and analysed obtaining the outcomes considering the parameters like maximum displacement and story drifts. Thus, the acquired are as mentioned below.

B) Stilt+G+4 building with floating column at the Edge column position with recommendations considering Infill walls,

In this model, the body designed with floating columns at the Edge column role are modelled and analysed acquiring the results thinking about the parameters like maximum displacement and story drifts. Thus, the acquired are as mentioned underneath.



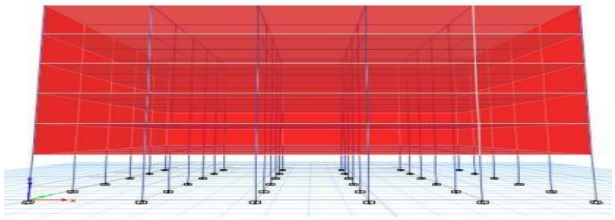


Fig 8: Plan view of the floating column

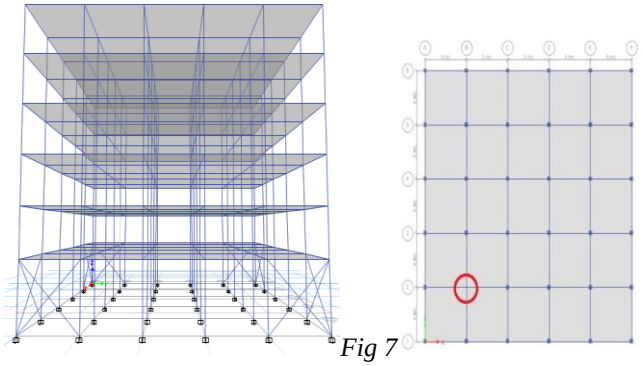
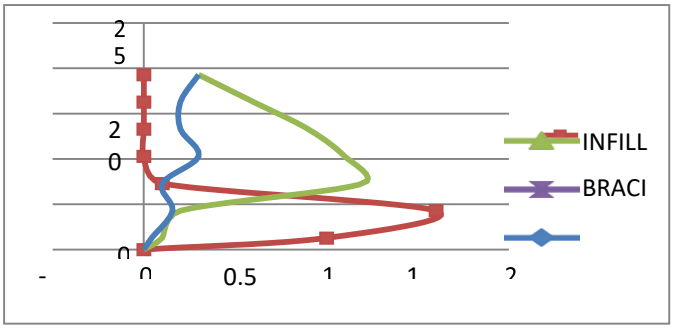


Fig 7 : Maximum displacements of the floating column at Edge column position from zone5 to zone2, with Infill walls

C) Stilt+G+4 building with floating column at the Edge column position with recommendations considering Steel Bracing,

In this version, the frame designed with floating columns at the Edge column position are modeled and analyzed obtaining the outcomes considering the parameters like most displacement and story drifts. Thus, the received are as mentioned beneath.



Comparison of the consequences found inside the

Story	Elevation	Location	INFILL	BRACING	SHEAR
Base	0	Top	0	0	0
Story1	1.28	Top	1.6	0.2	0.1
Story2	4.28	Top	2.6	0.3	0.1
Story3	7.28	Top	0.1	1.9	0.3
Story4	10.28	Top	0	1.8	0.4
Story5	13.28	Top	0	1.4	0.4
Story6	16.28	Top	0.1	1	0.4
Story7	19.28	Top	0	0.5	0.3

Story	Elevation	Location	INFILL	BRACING	SHEAR
Base	0	Top	0	0	0
Story1	1.28	Top	1	0.1	0.04
Story2	4.28	Top	1.6	0.2	0.16
Story3	7.28	Top	0.1	1.2	0.1
Story4	10.28	Top	0	1.1	0.3
Story5	13.28	Top	0	0.9	0.2
Story6	16.28	Top	0	0.6	0.2
Story7	19.28	Top	0	0.3	0.3

above fashions that is Maximum displacements, Story drifts, Response spectrum analysis, of the ordinary constructing, floating column constructing and floating column building with pointers.

In here we talk about the results located from the analysis of the fashions, thinking about the parameters like most displacements, tale drifts and we have a look at an powerful results on the reaction spectrum evaluation finished. Then the constructing frames with floating columns are generally tend to fail in the seismic zones, then pointers are proposed in the sort of situations.

And the consequences as a consequence acquired are as discussed below,

Fig 10: Comparison of Maximum Displacements of the Floating column at Parallel position, Zone 2

When we take a look at the effects obtained from zone5 to zone2, the most displacements and story drifts are obtained at better values.

Then evaluating the floating column constructing frame at Edge column role, Centre column portion and Parallel column position within the body. Thus the results are discussed as beneath,

Table 8: Comparison of Maximum Displacements of the Floating column at Parallel position, Zone 2

Hence, we will keep in mind that the ordinary column building body indicates less most displacements and story drifts while compared with the floating column at edge and centre column positions and comparative with the floating column at parallel column function, giving us clean understating that the floating column building is extra generally tend to fail in higher excitations, if exerted on them.

Thus, after comparing the fashions with tips considered in the safer and economical design, it is determined that the frames with shear walls are tons top-rated while in comparison with other hints. Thus, we can conclude that even after tips taken into consideration in the design the ordinary constructing have lesser displacements and drifts, letting us conclude that the floating column constructing generally tend to have greater displacements and their consequences on it are greater whilst as compared. And the design of the sort of building is better in value than a normal building expenses.

Hence the final conclusions observed are discussed clearly, in the next chapter.

6.CONCLUSIONS

The take a look at in this paper particularly comprises the distinction among a regular column building and a floating column constructing and then accompanied with the guidelines that can be advocated for a secure and affordable design of a floating column constructing which can be described as an earthquake resistant layout, and following conclusions are drawn from the evaluation,

1) Generally, a constructing becomes pricey if it's far designed to preserve any damage throughout an strong earthquake shaking.

2) In the existing study, it is discovered that the ordinary column constructing is more efficient whilst compared with other models i.E. Floating column homes.

3) From the effects it is observed that the building with floating column at Zone 2 and Zone three can be safe designed by means of increasing the dimensions of the beams and columns, while in Zone four and Zone 5 the Recommendations are in the end to be observed within the design.

4) Hence the pointers such as shear partitions, infill partitions, bracings are considered in the modeling and evaluation and discovered that they can also be designed as an earthquake resistant up to an volume, such that on introduction of floating columns

in the RC frames will increase the time period of naked frames due to decrease in the stiffness.

5) On contrast of the consequences acquired for every model, it is determined that the constructing with everyday column building have lesser displacements and tale drifts whilst compared with the floating column fashions.

6) Similarly, when the floating column models are as compared with each other, it is observed that the floating column constructing at one Edge column role have better displacements and tale drifts observed with the aid of floating column at parallel positions and finally the floating column at the centre component.

Finally, it is concluded that the floating column building, will lead to the boom in dimensions of the participants inside the structure to boom the stiffness and for the earthquake resistant design of the constructing with diverse hints taken into consideration which are more in value comparing with a ordinary building price of production. But following sustainable measures and pointers can even supply a earthquake resistant design of the building with floating column building constructed even at the better seismic sector.

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