SEISMIC ANALYSIS OF MULTISTOERY BUILDING WITH LOCATION OF FLOATING COLUMN

A thesis submitted in the partial fulfilment
Of the requirement for the degree

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IN

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BY

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LUCKNOW

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CERTIFICATE

Certified that **VIRENDRA KUMAR VERMA**(1180444013) has carried out the research work presentation in the thesis entitled **“SEISMICANALYSISOFAMULTI-STOREYBULDING WITH LOCATION OF FLOATING COLUMN”** for the award of **MASTER OFTECHNOLOGY (Structural Engineering) from** BABU BANARASI DAS UNIVERSITY, LUCKNOW under my supervision. The Thesis embodies results of original work, and studies are carried out by the student himself and the contents of the Thesis do not form the basis for the award of any other degree to the candidate or to anybody else from this or any other University/Institution.

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Declaration

I hereby declare that the Thesis entitled **"SEISMIC ANALYSIS OF MULTI-STORY BUILDING WITH LOCATION OF FLOATING COLUMN "** in the partial fulfilment of the requirements for the award of the degree of Master of Technology (Structural Engineering) of **BABU BANARASI DAS UNIVERSITY**, is record of the own work carried under the supervision and guidance of **Mr. FAHEEM AHMAD KHAN** to the best of my knowledge this Thesis has not been submitted to **BABU BANARASI DAS UNIVERSITY** or any other University or Institute for the award of any degree.

ABSTRACT

Earthquake in various pieces of the world have indicated unfavourable impact in multi-storey structures. Its impact is amplified in imperfectly planned structures and regular structures. Regular structures comprise a big area of the modem urban infrastructure. A structure is vertically regular on the off chance that it contains unpredictable dissemination of mass, quality and stiffness along the structure height. Floating column gave in a multi-story building makes an unpredictable structure with intermittent load path. Multi-story frame structure with floating column in at least one structures are in danger collapse during earthquake. Be that as it time, as of late ,structures in urban communities are required to have column free space for stylish and functional necessity .During earthquake the force created at various floor levels in a structure are should have been conveyed down by short path floating column brings about deviation or then again Story drift with break in this load way which brings about poor execution of the structure. In the current study the reaction of multi-story building frames with floating column at various locations has been studies.

Acknowledgement

I wish to express my deepest gratitude and indebtedness to my supervisors, **Mr. Faheem Ahmad khan** and to the Head of Department **Mr. Anupam Mehrotra** for their stimulating ideas, numerous constructive suggestions and guidance, continuous encouragement and invaluable support throughout this study. Without their advice, encouragement and support, this thesis would not be completed.

Finally, I would like to dedicate this research work to my family and friends (**Devesh patel**) whose continuous love and support guided me through difficult times.

Virendra Kumar Verma
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INTRODUCTION

1.1General

Now this time in many urban areas in India many multi-storey buildings are constructed but the main problem of the multi-storey building is to require a large space in the bottom or other floor of the building for parking, hall, and other purposes etc. That is why we make floating column buildings for the space in multi-storey buildings. Response of the structure during an earthquake depends upon its shape, size, geometry notwithstanding how the earthquake powers are conveyed to the ground. During earthquakes the earthquake power produced at numerous floors in the structure is brought down along the height to the ground by the most limited way any deviation or brokenness in this load transfer path results unsatisfactory of the structure. Floating column is a vertical member which is rest on the beam and not transfers the load by building at footing of the building

To design the beam on which the rest of the floating column carried all the load of the structure like a single point load. Structure of the beam required a big cross section and big steel material and material ratio. The brace pillar is likewise exposing torsion. The structure and specifying of this support bar is extremely vertical in the development of drifting section.

The later force during the earthquake required a linear path to transfer the lateral force to the foundation. But in case of floating columns the linear path is disturbing to transfer the lateral force to the foundation. These floating columns attract a lot of seismic force which is unfavourable in seismic zones. The floating column carried only vertical force of the building and its very unaccepted feature of the building in seismic zone. In this condition the activity of basic architects like us to guarantee that such structure is examined appropriately as well as the specifying of such structure is additionally done appropriately. Specifying the steel turns into an essential piece of floating column development.

1.2 Floating Column

A column in the buildings which is a vertical member starting the foundation of the building and transferring the load of the building on the ground. The floating column is vertical members which transfer the load from beam to another beam. The load transfer in any building is usually from slab to beam to column and the foundation but floating columns instead of transferring the load to the foundation transfer the load on the beam. The beam on which the floating column rests transfers to the column below. The load is transferred in the form of point load.

Now a day multi-storey building construction for residential, industrial or commercial purpose has a common feature. These multi-storey buildings need ample parking for or open space below. In multi-storey residential buildings to accommodate for the parking place and the turning radius, some of the columns forming the floor above create a problem. This region we make a floating column type building. Commercial multi-storey buildings have required a conference hall or banquet hall in the ground floor or other floor of the building. For the purpose we need a space in the building and make a floating column in the building. We carried floating columns at any floor of the building.

In any building the floor load is transferred to the column. But in case of floating columns the column transfers the load to the entire beam and beam transfers the load to foundation. The floating column is design as a regular column.

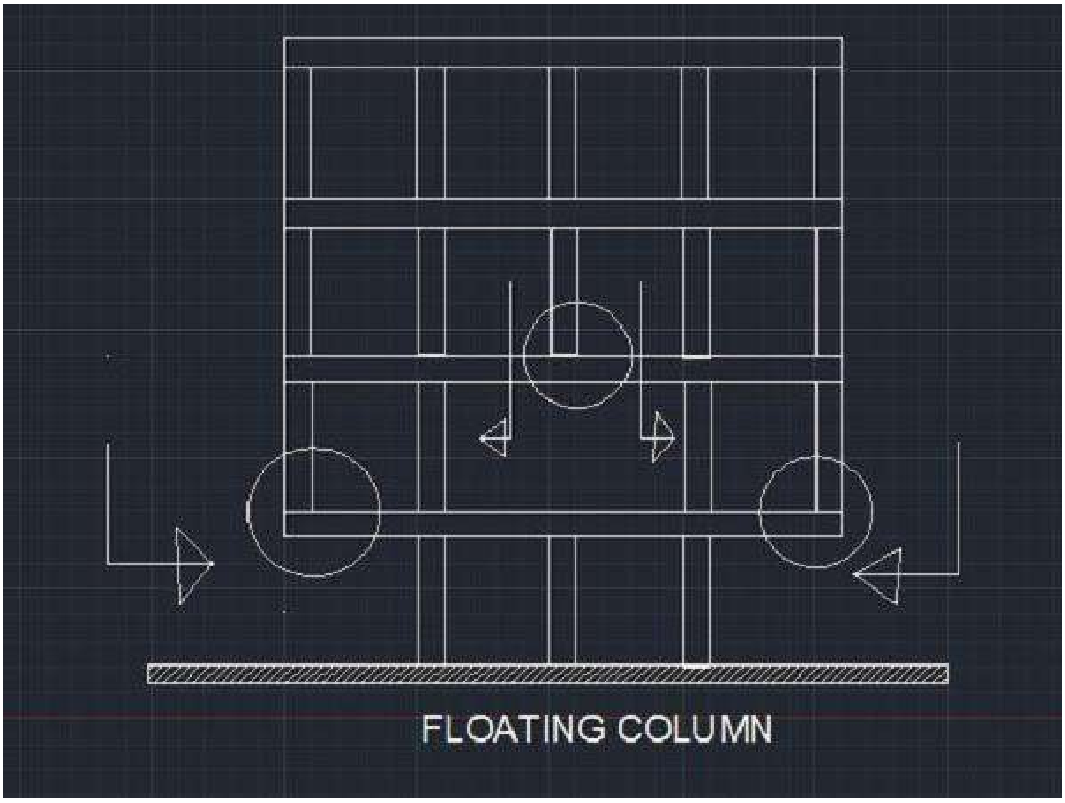


Fig 1.1 Show floating column

Fig1.2 Palestra in London, United Kingdom

Fig1.3 floating column building

Fig1.4 floating column building

1.3 OBJECTIVE OF THE STUDY

1. To study the comparative behaviour of multi-storey buildings with and without floating columns under earthquake force.

2. Analyze and modelling is done on software E.TABS.

3. To find the story drift, story displacement, base shear, time period of normal building and floating column at different locations of a G+14 RC multi-storey building.

1.4 SCOPE

1. Using definite element software, E.TABs, modelling of multi-storey frame structure with and without floating columns.

2. From ground level to the upper story level the column magnitudes result having show kind of dimension or modelled.

3. Dynamic analysis is completed by a time history method and is progressed out for the entire model**.**

4. Comparative study is decorated for all frames with and without floating columns.

CHAPTER-2

LITERATURE REVIEW

1. **Deekshita R., Dr. H. S. SureshChandra (2017**) In this study an exertion is made to analyze the structure is protected with floating columns as well as try to check the feasibility of the structure as it is conservative or not. A G+5 model is framed to dissect the structure for different locations of floating columns in the center of the ground story. Choosing bounds taken for examination is the displacement of the structure under different conditions and for financial investigation different materials are determined against different cases. The result of this investigation are displacement is more in building floating columns and to improve the strength sidelong shear wall is required and working with the coasting section isn't affordable.
2. **Snehal Ashok Bhoyar (2017)** An analysis of the structure exhibitions exposed to horizontal load under the impact of floating columns. G+5 building is chosen for building examination with or without column for regular arranged structure and irregular arranged structure. The investigation is done by a static analysis method which manages the assessment of different parameters against lateral loading. All the cases are displayed with floating columns in every one of the four corners for both standard and sporadic cases from the start floor as it were. The result shows that story drift in any structure is different regarding the basic structural plan of individuals and irregularities in the structure architecture. The result shows that story drift in any structure is changed as for the auxiliary course of action of individuals and abnormalities in the structure architecture. It is likewise seen that story drift is a component of horizontal displacement and winding or overturning of building. Here the drift ascends to half at the top of the structure.
3. **Mohammed Mustafa (2017)** Many review papers are studied related to the floating column structure in seismic areas under the earthquake load. This paper highlights the audit considers done on seismic investigation of the structure with floating columns by various creators. The examination is done on building models having different amounts of story of RCC with basic and complex floor plans with gliding sections. Finite element base technique to be E.TABS. Stadd pro are used for the examination which can discover parameters, for example, bending moment time period, story drift, and base shear. Time history strategy is used for the dynamic examination for the essential and complex structure.
4. **Jayashri Sarode, Mr. Anmol S. (2016)** In this study include the comparative investigation of common structure without floating column with floating column in lower story in straight forward

surrounded structure with RCC pillar to help drifting section in one case of composite beam in second case here for the situation steel solid composite beam is utilized for compression in normal RCC beam. Both the reaction range and static analysis is done against different parameters containing story shear, story displacement, story drift and result so got are the structures with floating columns performing the most extreme dislodging which show that flexibility is most elevated for the situation so the determination of the floating column is not found high. Also, in the reaction analysis the structure performs the most extreme story shear in the principal story and diminishes as the tallness of building increments in all cases.

5. **Karishma I. Patel (2016)** In this paper investigation of multi-storey structures are constructed with floating columns for motivation of getting more space at parking for development. In any case, the same case highly harmed during an extremely seismic zone when contrasted with ordinary structure in an earthquake. This study contemplates the seismic conduct of multi-storey structure with and without floating columns considered. And discover whether the structure is protected or risky with floating columns when worked in seismically active zones.
6. **Nakul A. Patil, Riyaz Sameer Shah (2016)** Main aim of this paper is to find the comparative study of floating column building and without floating column building. Four unique cases with different numbers of floating will be gotten ready for various cases. In this work correlation is done to check the reaction of RC frame structure for different cases under seismic force and typical loading and furthermore different parameters are inspected against different conditions in order to obtain the prevalent structure out of these cases. This investigation finds that the story drift is increments which increases the quantity of floating columns and furthermore the drift is higher practically identical to non floating column building. They additionally uncovered that giving floating column isn't perfect in higher seismic zone.
7. **S. B. Waykulee (2016**)In this review paper to investigated a G+5 multi-storey structure with and without floating column for earthquake zone V. Different parameter are taken contains base shear, story drift, story displacement and correlation of two cases modelled with floating column at center of first story and external fringe of all floors one after another and a structure without floating column. Correlation is accomplished for all parameters by direct static method and time history analysis for seismic investigation of IS 1893(Part 1):2002. Find of this investigation infers that timeframe, displacement and story drifts nearly more noteworthy in working with floating columns yet base shear is less in contrast with working without floating columns.
8. **Kadam S. S. Lale S. V. (2016)** In this audit paper the work is done on investigation of different research work done already in the field of floating structure for different provision conditions and different course of action of building plan of building. A portion of the cases will make a variety in

the number of floating columns alongside various stories inside the structure. A portion of the cases makes changes in the area of the floating column inside the structure. Different parameters are chosen to analyse the conduct of working under different conditions which would give a momentous end. Different techniques for investigation for example time history method, response spectrum method and for examination are utilized for analysis of the structure by different programming like etabs, staad pro.

9. **Ms. Priyanka, D. Mothgare (2016)** This paper relates to analytical examinations completed to assess the work of RCC frames under various positions of floating columns. Structures with a column that hangs on a beam at a middle of the road story and don't go right to the establishment, have discontinuities in the load transfer. The investigation had been done on a five story RCC outline structure which has been dissected. Investigation was completed considering various places of floating columns by utilizing STAAD experts. The impact of the position of the floating column was also examined. The twisting was higher for all the floating column cases. The last most extreme bending moment esteems were additionally affected by the nearness of the floating column.
10. **Sharma R. K. (2016)** In urban India floating column building was a common component in the multi-storey construction. Structures with floating columns were received either for building perspective or when all the more free space was required in the ground floor. Such highlights were exceptionally undesirable in seismically active zones. The work considers the examination of G+5, G+7, G+9, G+11 and G+13 story working with floating columns and without floating. The examination has been finished by utilizing Staad Pro V8i programming by utilizing Response spectrum analysis. The paper manages the variety in bringing about displacement of structure, base shear, Seismic weight calculation of the structure from manual estimation and Staad expert V8i. For structure with floating column and working without floating column, finding the variety between the reaction parameter of earthquake and describing what happens when variety might be high or low.
11. **Gangadari Vishal Kumar (2016)** This examination features the significance of exactly acknowledging the component of the floating column in the investigation of building. Substitute measures, including stiffness equalization of the primary story and the story above, are proposed to decrease the irregularity presentation by the floating column. FEM codes are produced for 2D multi story frames with and without floating columns to examine the reactions of the structure under various seismic earthquake excitations having different frequency content keeping the PGA and time term factor consistent. The time histories of floor displacement, story drift, base shear, upsetting second are registered for both the model with and without floating column.
12. **Badgireudhav S. (2015)**in this review paper study concluded on a multi-storey building without floating columns in three cases consisting of removal of the outer column in corners and examined

for equivalent static methods. All the cases comprise three stages in which every floor plan is chosen where in the first stage base stories are chosen for parking reason, middle stories are chosen for residential reason and the upper stories are chosen ready for residential reason additionally however with various courses of arrangement. A few parameters are chosen for determination also the outcome is concluded that load of disappointment is more in the model containing floating columns in two longer sides as constructed with two shorter sides. Likewise the estimation of share power is shifting essentially as for the position and direction of section.

13. **Keerthi Godwa B. S, Syed Tajoddeen (2014)** The point this paper to contemplate the impact of the quake power of the multi-story working in the seismic zone. In this paper there were three kinds of models: contrast and the boundary. First model is without floating column and second is with floating column at the substitute floor in all corner sides and the third model with the same structure with drifting floating giving parallel propping is analysis at various parameters. Result is the sidelong propping floating column type building having more quality of the structure and decreasing the story drift by a subsequent measure of 18.28%.

14. **Sriknath M. K., Yogendra(2014)**In this examination work presents a portion of the difficult chance in the structure. A few cases are modelled in combinations which involves floating column in ground floor at various area, floating column with expanded floor to floor stature and floating column with high pressure for earthquake zones II and zone V. End drawn against inspecting different parameter for different conditions is that floating column under high load, expanded story tallness in blend isn't effective and henceforth not fitting. Story drift is fluctuated more in the event of mixing of floating columns with expanded height and overload. Likewise the displacement continues expanding with higher zones. So it might likewise be presumed that the drifting is exclusively utilized at certain cases yet with no blend to decrease the stiffness.
15. **Shivam tyagi (2014)** Basic arranging and configuration is a skill and study of planning with economy and class and sturdy structures. In present situation structures with floating columns are a run of the mill included in the advanced multi-storey development in urban India. Such highlights are exceptionally unfortunate in building work in seismically dynamic areas. Tremendous increment in the utilization floating column can be seen nowadays for roomy and stylish appearance however that couldn't be accomplished on the danger of disappointment of building. This examination features the significance of unequivocally perceiving the nearness of the floating column in the result of building.

The investigation is done to the structure with floating column and to discover its compression with the structure without floating column as far as story drift, base shear using software.666

16. **.Kishalay Maitra. (2014**) In this time multi-story development, floating columns are an unavoidable quality of structures. Such highlights are profoundly unfortunate in building work in seismic inclined zones. This examination features the exhibition of floating column assembling and contrasted and ordinary structure under seismic load. In this examination, static and dynamic investigations utilizing reaction range techniques have been done for multi-story working with and without floating columns.
17. **AP. Mundda. S. G. Sawadakar (2014)** In this paper study is analysis for engineering drawing and the structural drawing of the structure having floating columns. For comparison G+7 existing residential structure with and without floating column are taken for do whole frame by using STAAD ProV8i 3D 3 model are made equal static method of these model are finished by utilizing STAAD Pro V8i .Different parameter, for example, axial load, moment distribution, significance of line of activity of power and seismic components are read for models. This will assist them with finding the different scientific properties of the structure and furthermore have an exceptionally deliberate and affordable plan for the structure.
18. **Susanta Banerjee, Sanjay kuamr patra (2014)** Now this paper presents the impact of stiffness of infill wall to damage to the floating column building when ground shakes. Modelling and results are done by a non linear investigation program IDARC-2D. Damage happened in beam, column, story are concentrated by planning changed Park and Age model to assess harm records. Generally speaking lists in structures because of shaking of ground are likewise gotten. Dynamic reaction boundaries for example sidelong floor relocation, story drift, time period, base shear of structures are obtained and results are contrasted and the standard second opposing edge structures. Arrangement of breaks, yield, plastic hinge, are likewise saw during investigation. from this it is reasoned that sidelong floor removal ,story float of coasting section working with infill divider are diminished than skimming segment working without infill wall.
19. **Peera Nautiyal, Saleem Akter (2014)** Aim in this paper examine the impact of a floating column under earthquake excitation for different soil conditions and as there is no arrangement or amplification figure determined I.S. Code, subsequently the assurance of such factors for safe and economical structure of a structure having floating columns. Linear Dynamic Analysis is accomplished for 2D multi story outline with and without floating column. For that reason the model G+4 and G+6 building has changed the situation of floating columns. After that reaction response spectrum analysis is accomplished for both structures. dynamic reaction parameters such as base shear and moment for hard and medium soil condition are gotten for both structure models.

20. **Sreeknath Gandala, Pradeep Kumar (2014)**In this paper discover whether structure is safe or unsafe with floating columns when working in an earthquake zone and find floating column building is economical or uneconomical. For that reason investigation of G+5 story typical structure and floating column building are accomplished for external lateral force. These examinations done by utilizing sap2000.external lateral load are determined manually. Utilizing an equal static method for analysis created 2D3 model, model1, model2, model3, model1 is a typical structure with the same measurement beam and column. Model2 is floating column structure without changing dimensions, model3 is floating column building with changing components of beam and column. Also, think about the both structure dependent on displacement due to lateral load model1, model2.model3 .also dependent on stiffness, and dependent on time history examination.

CHAPTER-3

WORK METHODOLOGY

3.1 General

The research methodology was started with the issue of RC multi-story structures under seismic activity and setting up the goals and scope of study. At that point all the related background data were stored and read for the literature survey for information update. The aim of the study was building modelling and computational analysis utilizing time history analysis methods in ETABs. Seismic analyses like story stiffness, time period, story displacement, base shear are analysis using E.TABS. The result obtained from the analysis to compared with normal building and floating column building.

3.2 Description of building plane

For this analysis to carry out G+14 high rise multi-storey building is modelled in E.TABS. A RC G+14 multi-storey building having the same floor plane with 6bays to 3bays. The total height of the building is 45m. The building is analyzed by a time history analysis method.

1	Building type	Residential building
2	No. Of story	G+14
3	Floor height	3m
4	Total Height	45m
5	Size of column	450mm*450mm
6	Size of beam	300mm*400mm
7	Thickness of slab	120mm
8	Seismic zone	5
9	Response reduction factor	5
10	Important factor	1
11	Grade of steel	Fe450
12	Grade of concrete	M25
13	Damping	5%
14	IS Code of concrete	IS456:2000
15	IS Code of earthquake	IS1893 Part-1 2016
16	Self weight factor	1

Table3.1 Description of building

3. 3Method of analysis

3.3.1 Dynamic analysis method

(A) Linear

1. Response spectrum method

(B) Non linear

1. Time history analysis

Dynamic analysis method

Linear dynamic analysis will be performed to find the structure horizontal force (plan seismic base shear, and its distribution to various levels along the height of the structure, and to different parallel height ahead resisting element) for all structures, other than normal structures lower than 15 m in Seismic Zone II.

The systematic model for dynamic analysis of structures with bizarre design ought to be to such an extent that it sufficiently represents irregularities present in the structure.

Dynamic investigation may be performed by either the Time History Method or the Response Spectrum Method. When both of the techniques are utilized, the plan base shear VB evaluated will not be not exactly the structure.

Base shear ($\bar{V}_B$) calculating a fundamental time period $T_{a.}$

T_a =

$\{0.075h\ (for\ RC\ building)\ 0.080h\ (for\ RC\ steel\ composite\ building)\ 0.085h(for\ steel\ building)$

(where h= $h^{.75}$)

Where VB is less than $\bar{V}_B$.

The force response quantities (for example ember stress resultants, story shear forces, and base reactions) shall be multiplied by $\bar{V}_B/V_B$.

The earthquake force along the 2 common vertical plane directions is X and Y.

To calculate the spread multiply factor $\bar{V}_{BX}/V_{BX}$and $\bar{V}_{BY}/V_{BY}$.

For the Z direction multiplied factor is

$$\text{Max}\ [\bar{V}_{BX}/V_{BX},\ \bar{V}_{BY}/V_{BY}]$$

3.3.1. A.1 Response spectrum method

Response spectrum analysis is a strategy for calculating the most peak response of a structure when applied with ground movement. Every one of the vibration modes that are considered are expected responses as an individual degree of freedom. Design codes indicate response spectra which decide the base acceleration applied to every mode as per its period. Having calculation, the reaction of every vibration mode to the excitation, it is important to get the reaction of the structure by combination the impacts of every vibration mode on the grounds that the maximum response of every mode not compulsory at a similar moment, the linear maximum response where damping is zero, is taken as whole of squares (SRSS) of the individual responses. The conclusions of the response spectrum are on the whole perfect values and so they should be joined as they don't compare to any balance state nor they occur simultaneously. In this analysis the greatest response as far as given parameters like G(velocity, acceleration, velocity)might be accessed through the square root of sum of m modular response squares, adding to worldwide response.

$$G = \Sigma mn{=}1\ (Gn)^2$$

3.3.1s. B.2 Time history method

It is an important procedure for building seismic analysis particularly when the calculated structure reaction is nonlinear. Time history analysis is a step by step producer of the dynamic reaction of a structure to a given load that may change with time. A full time history will give the reaction of a structure over the time during and after the utilization of a load. To determine the full time history of a structure's reaction A straight time history analysis defeats all the weaknesses of a modular response spectrum analysis given nonlinear behaviour isn't included. This technique requires more computational effect for calculation the reaction at discrete time. It is utilized to decide the dynamic reaction of a structure to subjective loading.

3.3 Parameter consider by analysis

1. Story displacement
2. Story drift
3. Story stiffness
4. Time period
5. Base shear

3.4 Structure modelling

Software E.TABs is utilized for seismic analysis and to study the comparative behaviour of multistory structure with and without floating columns. Various models are made and compared with different parameters of analysis. Complete investigation including building modelling is acted in this software.

In this study consider a RC G+14 multi-storey building having the same floor design with 6 lays to 3 lays. Four different types of model are selected in order to find performance of the building in a seismic zone. The total height of the building is 45m and the height of each floor is 3m.

There are four different models which is as follows:

1. First model is carried out RC frame normal G+14 building.
2. Second model is carried out RC building with a floating column on the first floor.
3. Second model is carried out RC building with a floating column on the seventh floor.
4. Second model is carried out RC building with a floating column at the top floor.

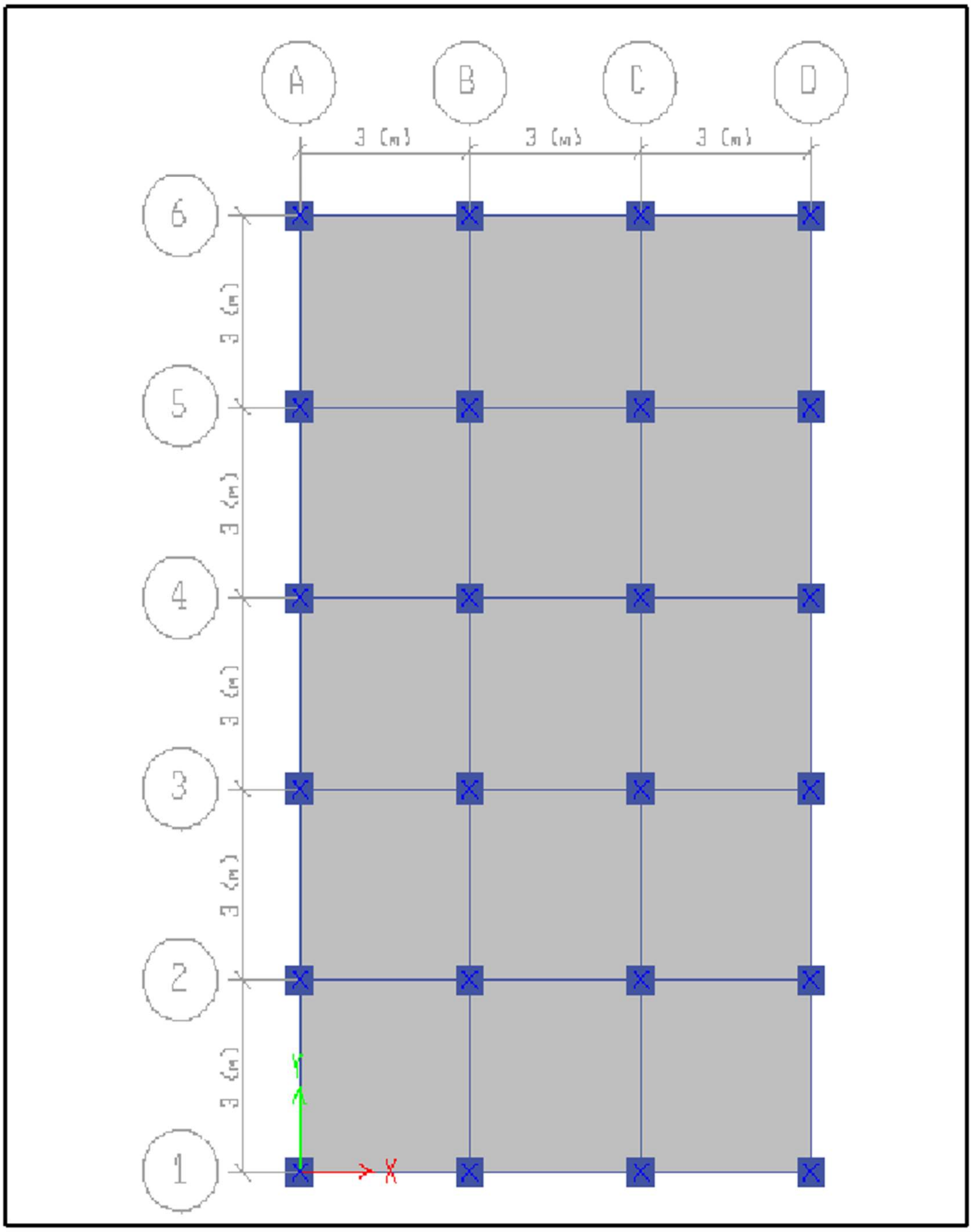


Fig3.1Plane of the building

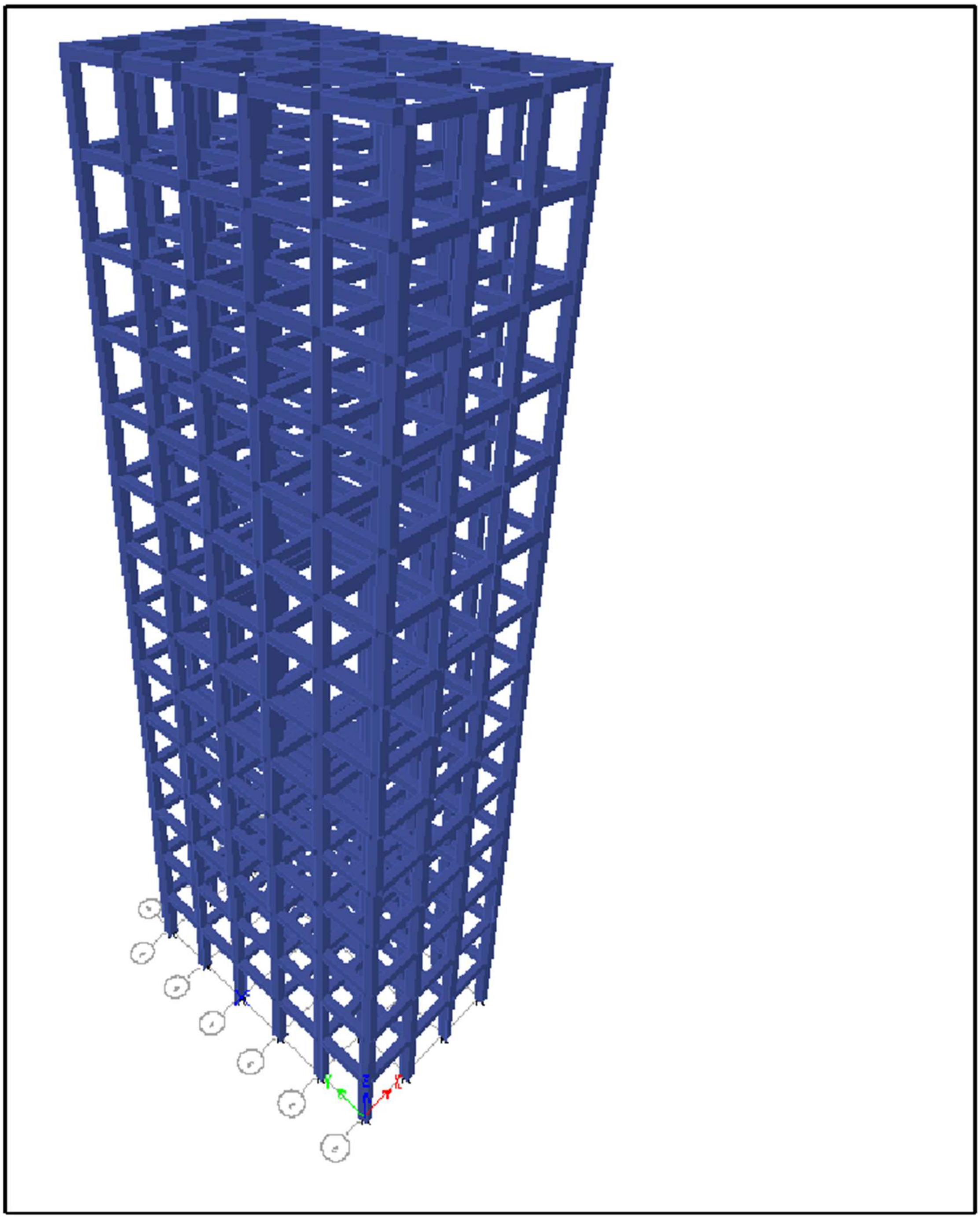


Fig3.2 RC frame normal building

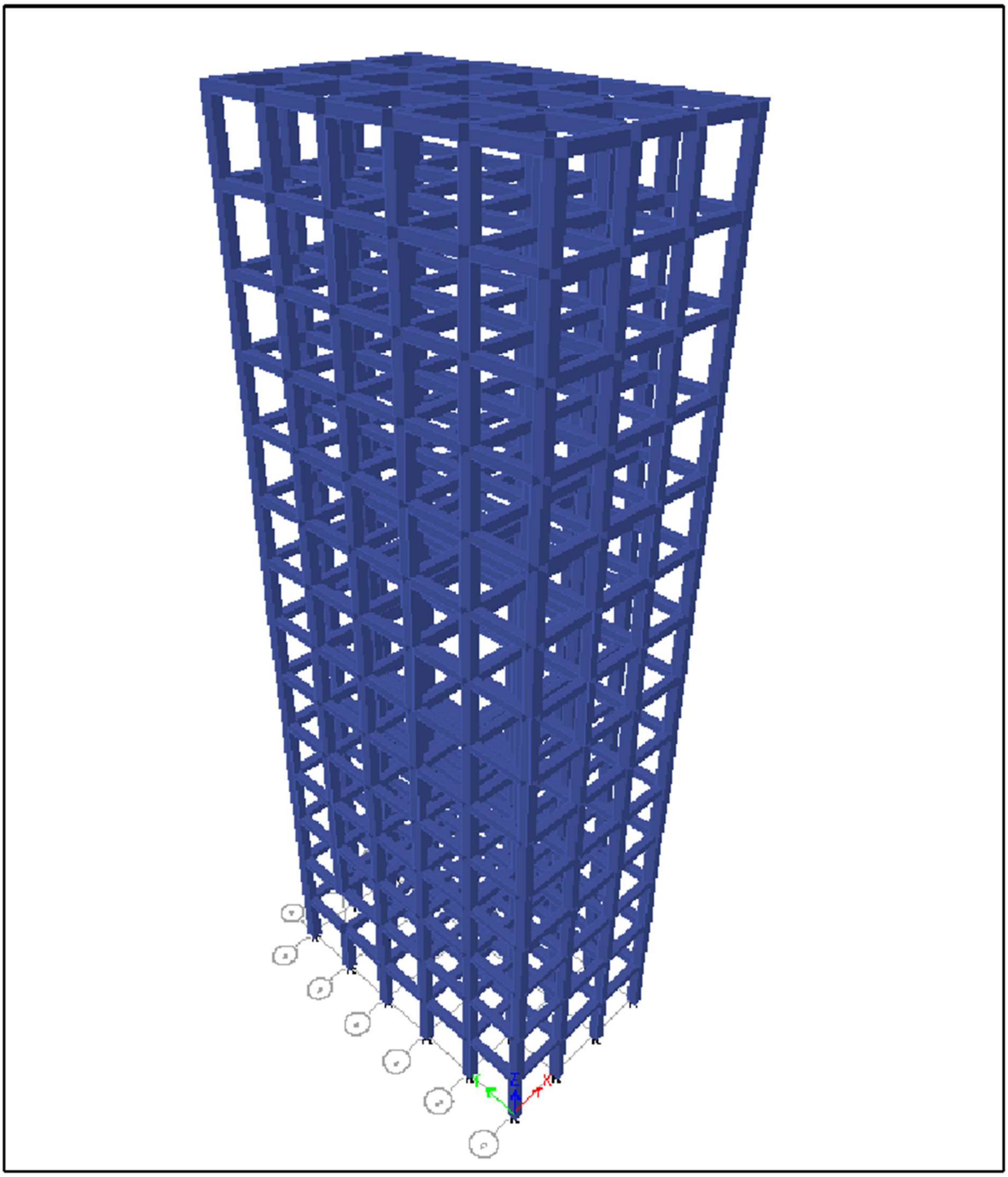


Fig3.3 RC frame floating column at first floor

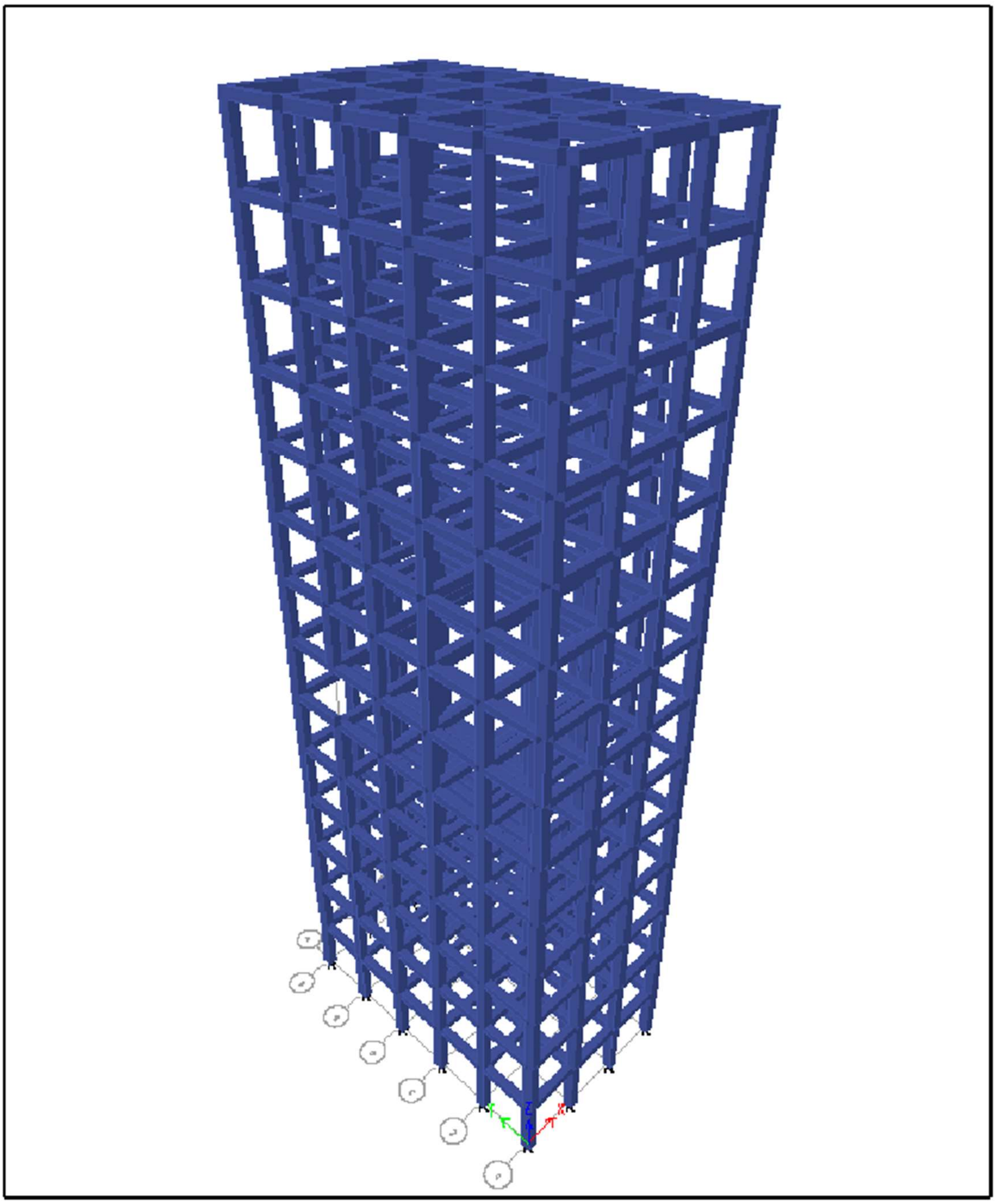


Fig3.4RC frame floating column at seventh floor

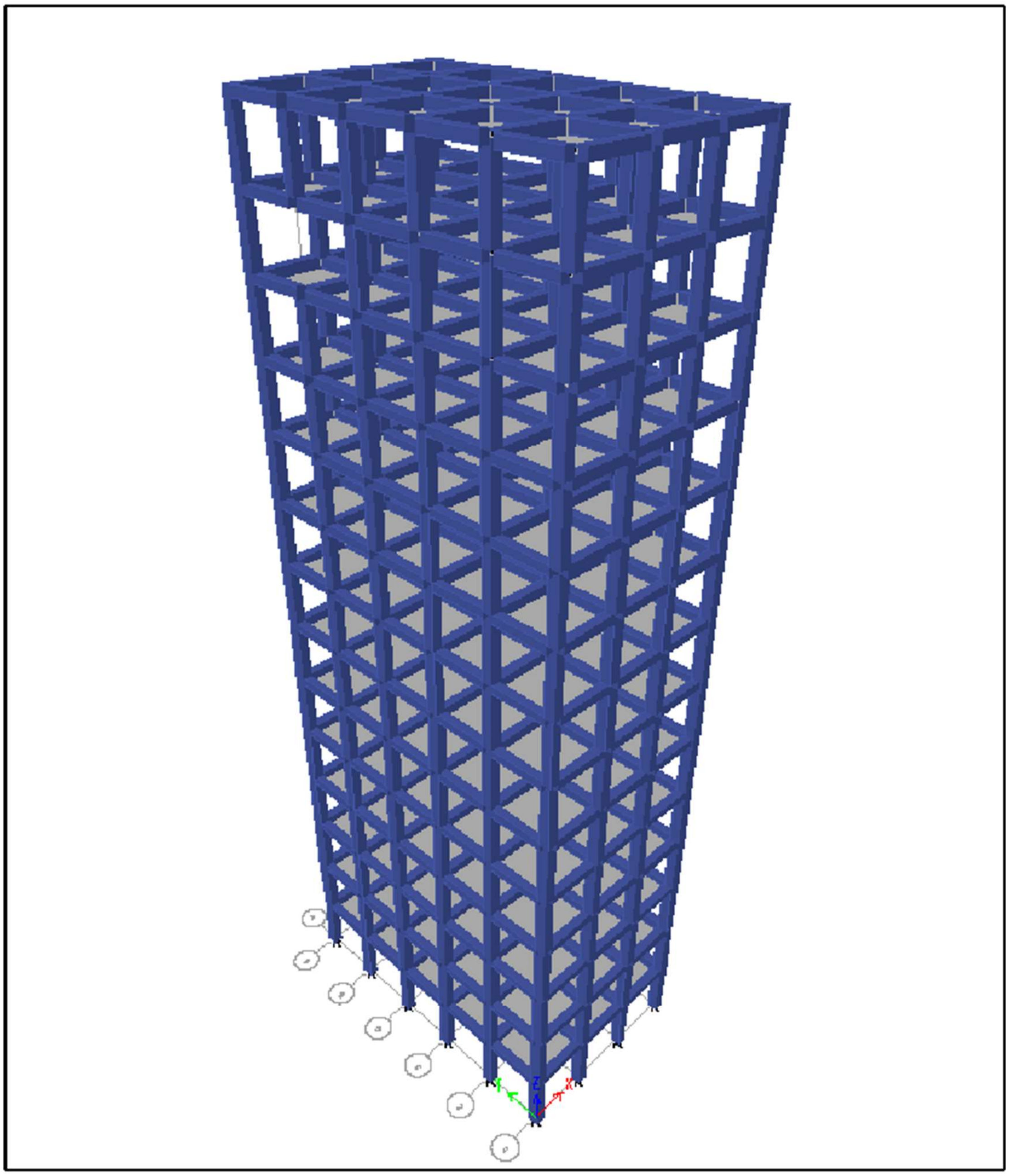
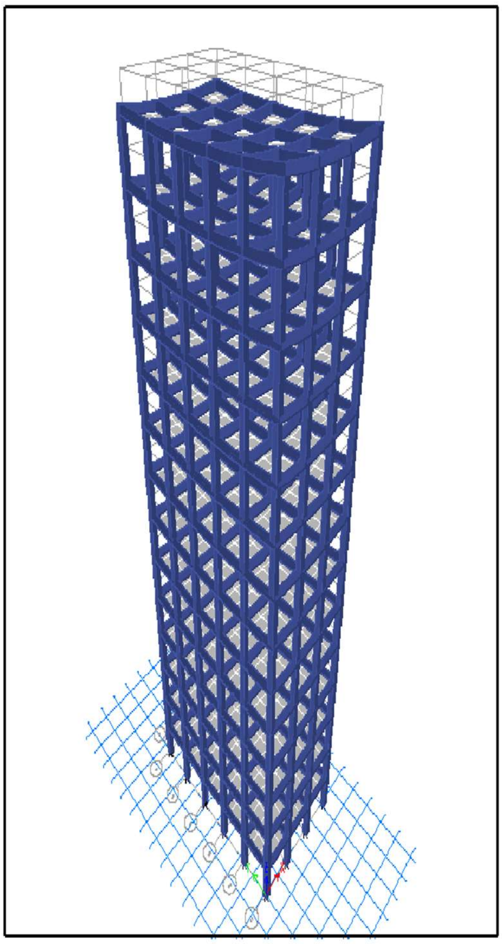


Fig3.5 RC frame floating column at top floor



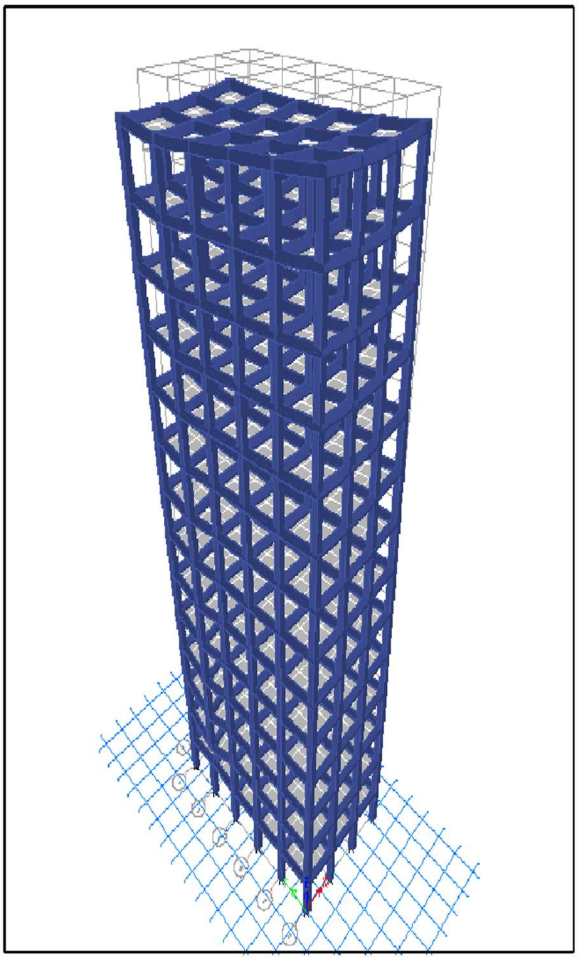
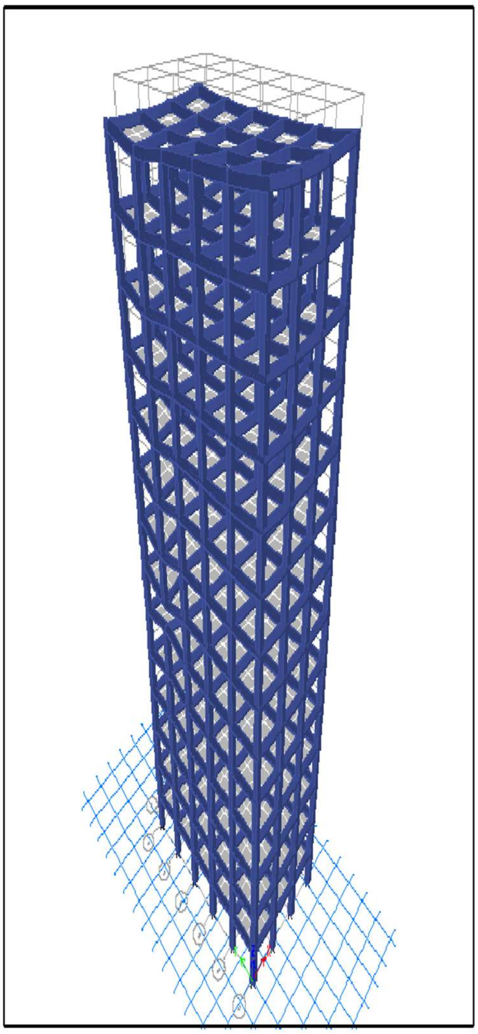


Fig3.6 Displacement of full frame building

Fig3.7 Displacement of 1st floor



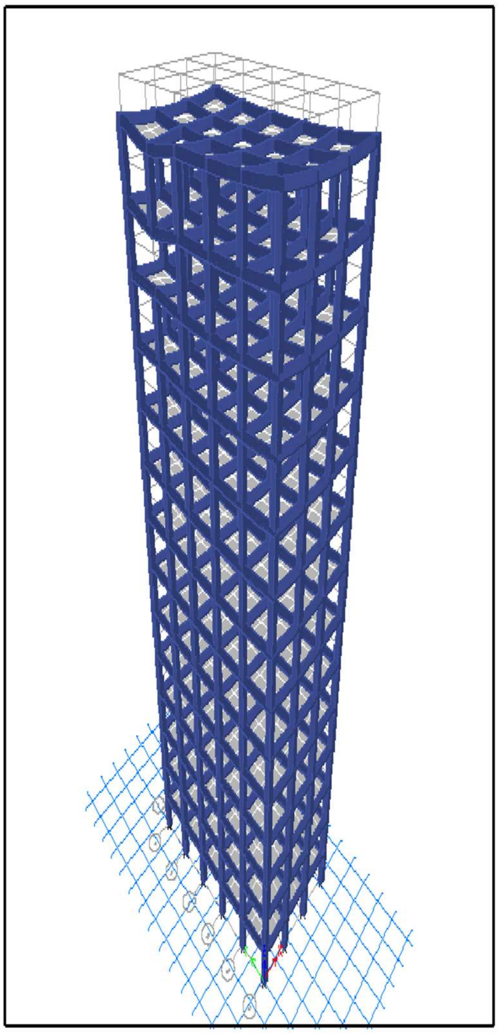


Fig3.8 Displacement of 7th floor

Fig3.9 Displacement of top floor

CHAPTER-4

RESULT

4. RESULT

4.1 Story displacement Story displacement is the absolute value of displacement of the story under the action of lateral force. According to IS1893 Part1-2016 the maximum value of displacement is 1/25 time of story height with respect to ground.

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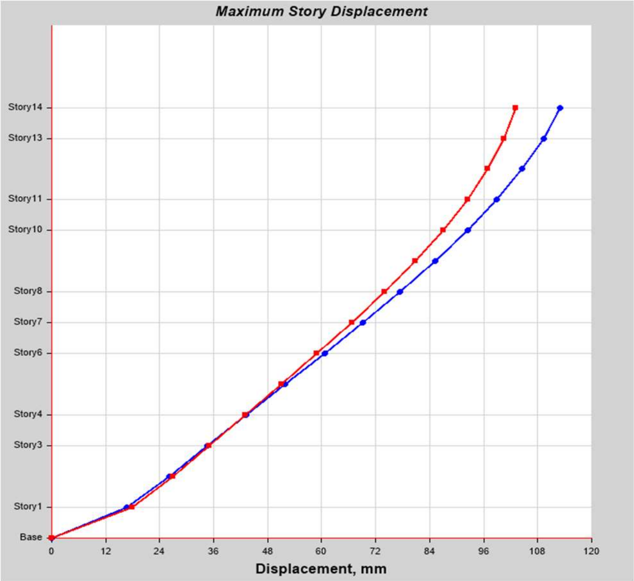
Story	Elevation	Location	X-Dir	Y-Dir
	M		mm	Mm
Story14	42	Top	106.781	111.248
Story13	39	Top	103.624	107.949
Story12	36	Top	99.491	103.648
Story11	33	Top	94.438	98.42
Story10	30	Top	88.573	92.364
Story9	27	Top	81.926	85.502
Story8	24	Top	74.637	77.967
Story7	21	Top	66.872	69.919
Story6	18	Top	58.789	61.509
Story5	15	Top	50.531	52.87
Story4	12	Top	42.222	44.12
Story3	9	Top	33.954	35.344
Story2	6	Top	25.693	26.539
Story1	3	Top	16.608	17.101
Base	0	Top	0	0

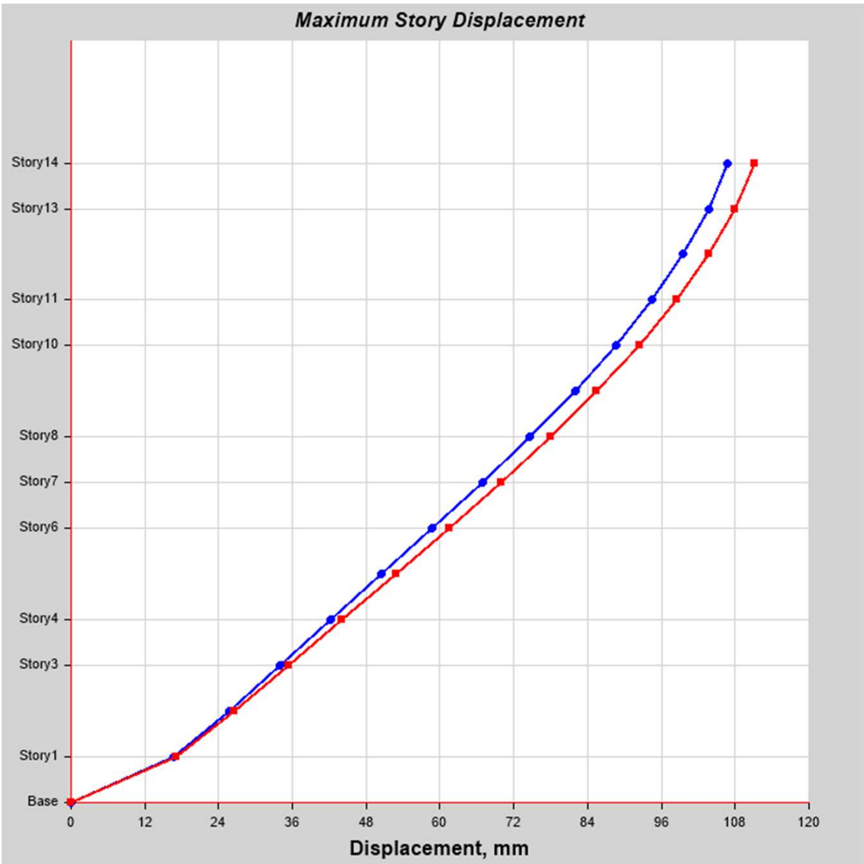
Table4.1 Story displacement of normal building



Graph4.1 Story displacement of normal building

Story	Elevation	Location	X-Dir	Y-Dir
	M		mm	Mm
Story14	42	Top	113.014	103.121
Story13	39	Top	109.305	100.511
Story12	36	Top	104.599	96.91
Story11	33	Top	98.968	92.377
Story10	30	Top	92.531	87.019
Story9	27	Top	85.321	80.857
Story8	24	Top	77.484	74.026
Story7	21	Top	69.196	66.687
Story6	18	Top	60.619	58.988
Story5	15	Top	51.907	51.066
Story4	12	Top	43.193	43.036
Story3	9	Top	34.577	34.985
Story2	6	Top	26.035	26.878
Story1	3	Top	16.641	17.826
Base	0	Top	0	0

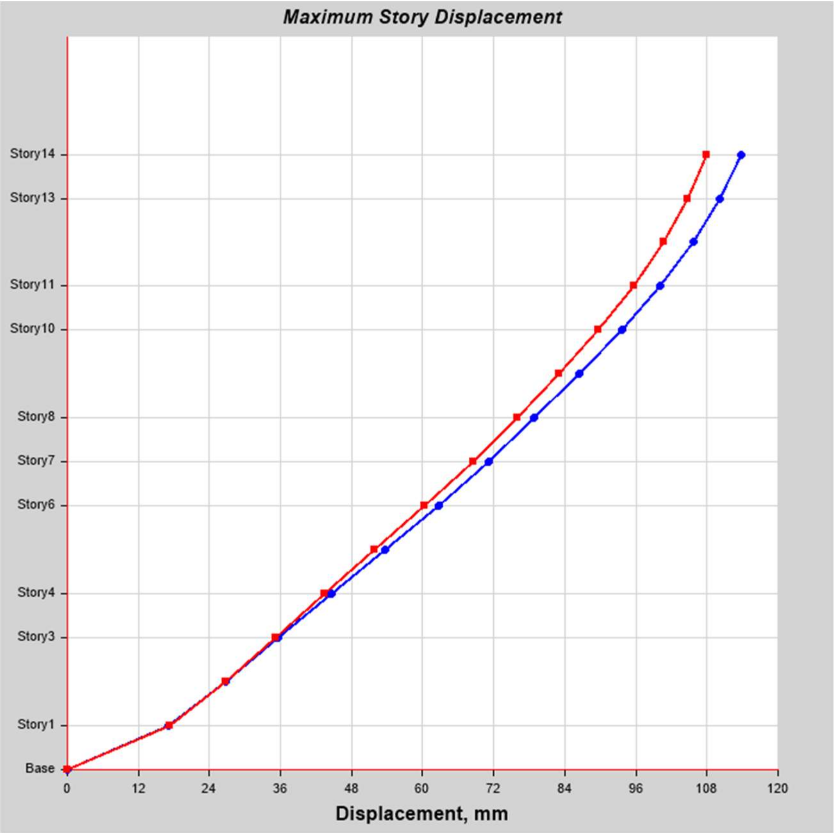
Table4.2 Story displacement of FC at 1st floor



Graph4.2 Story displacement of FC at 1st floor

Story	Elevation	Location	X-Dir	Y-Dir
	M		mm	mm
Story14	42	Top	113.836	107.861
Story13	39	Top	110.246	104.795
Story12	36	Top	105.638	100.696
Story11	33	Top	100.078	95.638
Story10	30	Top	93.686	89.733
Story9	27	Top	86.498	83.009
Story8	24	Top	78.862	75.916
Story7	21	Top	71.245	68.635
Story6	18	Top	62.665	60.307
Story5	15	Top	53.598	51.943
Story4	12	Top	44.532	43.507
Story3	9	Top	35.599	35.104
Story2	6	Top	26.778	26.686
Story1	3	Top	17.118	17.325
Base	0	Top	0	0

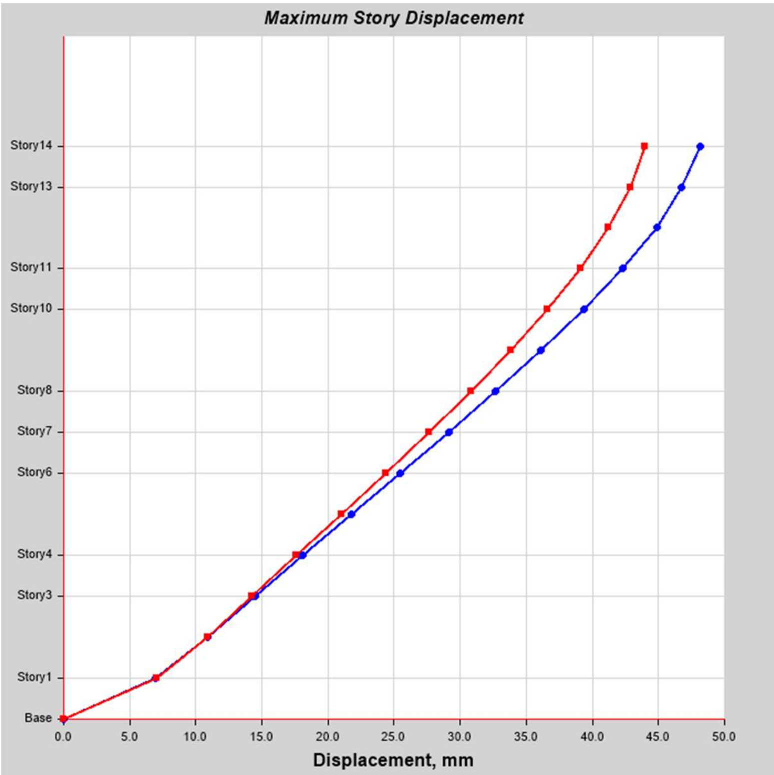
Table4.3 Story displacement of FC at 7th floor



Graph4.3 Story displacement of FC at 7th floor

Story	Elevation	Location	X-Dir	Y-Dir
	m		mm	mm
Story14	42	Top	48.117	43.961
Story13	39	Top	46.711	42.849
Story12	36	Top	44.85	41.167
Story11	33	Top	42.282	39.072
Story10	30	Top	39.347	36.606
Story9	27	Top	36.125	33.84
Story8	24	Top	32.691	30.84
Story7	21	Top	29.109	27.666
Story6	18	Top	25.442	24.372
Story5	15	Top	21.745	21.009
Story4	12	Top	18.077	17.625
Story3	9	Top	14.466	14.245
Story2	6	Top	10.892	10.848
Story1	3	Top	6.97	7.052
Base	0	Top	0	0

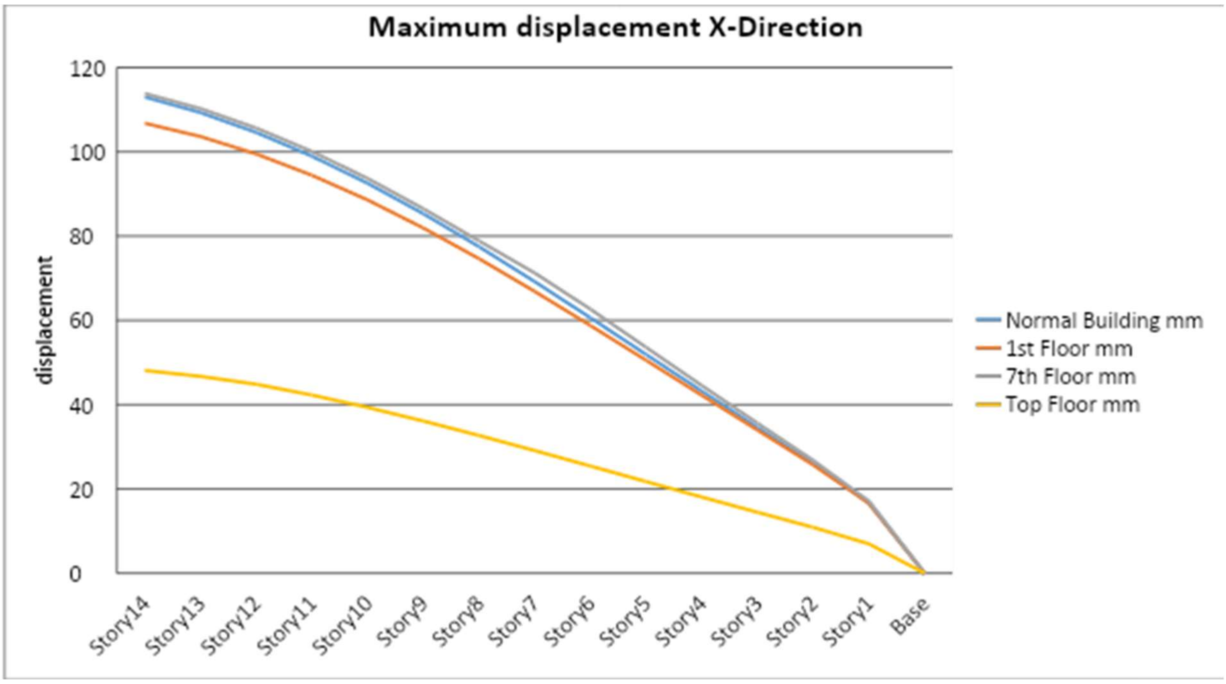
Table4.4 Story displacement of FC at top floor



Graph4.4 Story displacement of FC at top floor

Story	Normal Building	1st Floor	7th Floor	Top Floor
	Mm	mm	mm	mm
Story14	113.014	106.781	113.836	48.117
Story13	109.305	103.624	110.246	46.711
Story12	104.599	99.491	105.638	44.85
Story11	98.968	94.438	100.078	42.282
Story10	92.531	88.573	93.686	39.347
Story9	85.321	81.926	86.498	36.125
Story8	77.484	74.637	78.862	32.691
Story7	69.196	66.872	71.245	29.109
Story6	60.619	58.789	62.665	25.442
Story5	51.907	50.531	53.598	21.745
Story4	43.193	42.222	44.532	18.077
Story3	34.577	33.954	35.599	14.466
Story2	26.035	25.693	26.778	10.892
Story1	16.641	16.608	17.118	6.97
Base	**0**	**0**	**0**	**0**

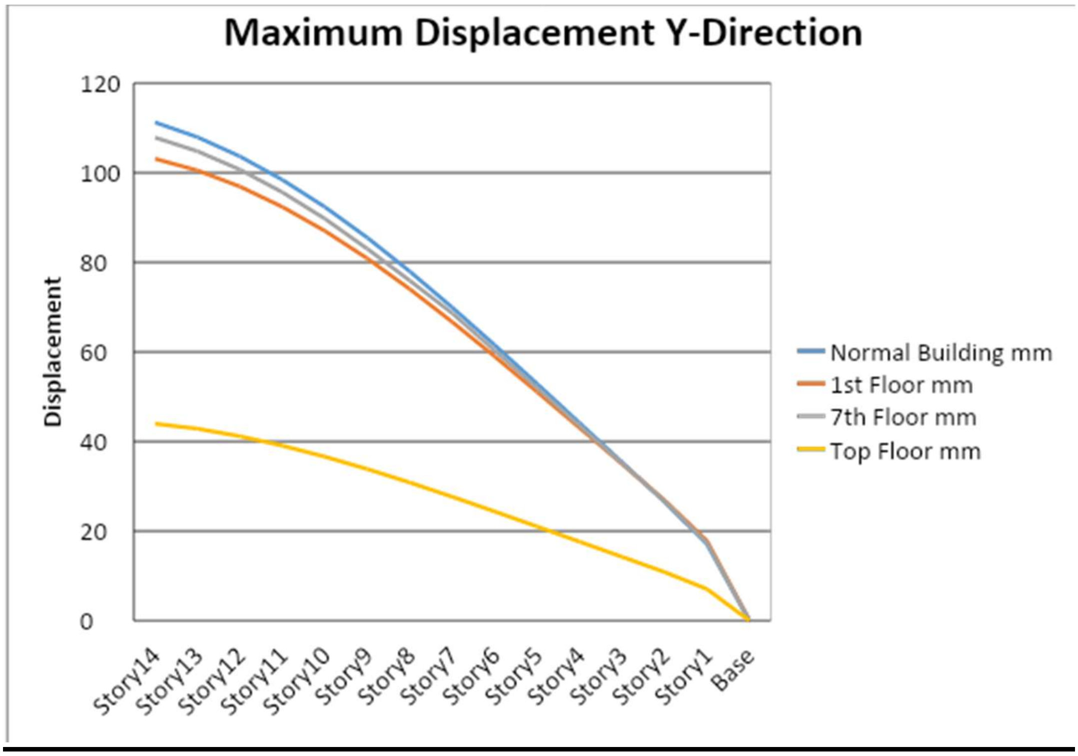
Table4.5 Comparative maximum Story displacement in X-direction



Graph4.5 Comparative maximum Story displacement in X-direction

Story	Normal Building	1st Floor	7th Floor	Top Floor
	Mm	mm	mm	mm
Story14	111.248	103.121	107.861	43.961
Story13	107.949	100.511	104.795	42.849
Story12	103.648	96.91	100.696	41.167
Story11	98.42	92.377	95.638	39.072
Story10	92.364	87.019	89.733	36.606
Story9	85.502	80.857	83.009	33.84
Story8	77.967	74.026	75.916	30.84
Story7	69.919	66.687	68.635	27.666
Story6	61.509	58.988	60.307	24.372
Story5	52.87	51.066	51.943	21.009
Story4	44.12	43.036	43.507	17.625
Story3	35.344	34.985	35.104	14.245
Story2	26.539	26.878	26.686	10.848
Story1	17.101	17.826	17.325	7.052
Base	0	0	0	0

Table4.6 Comparative maximum Story displacement in Y-direction

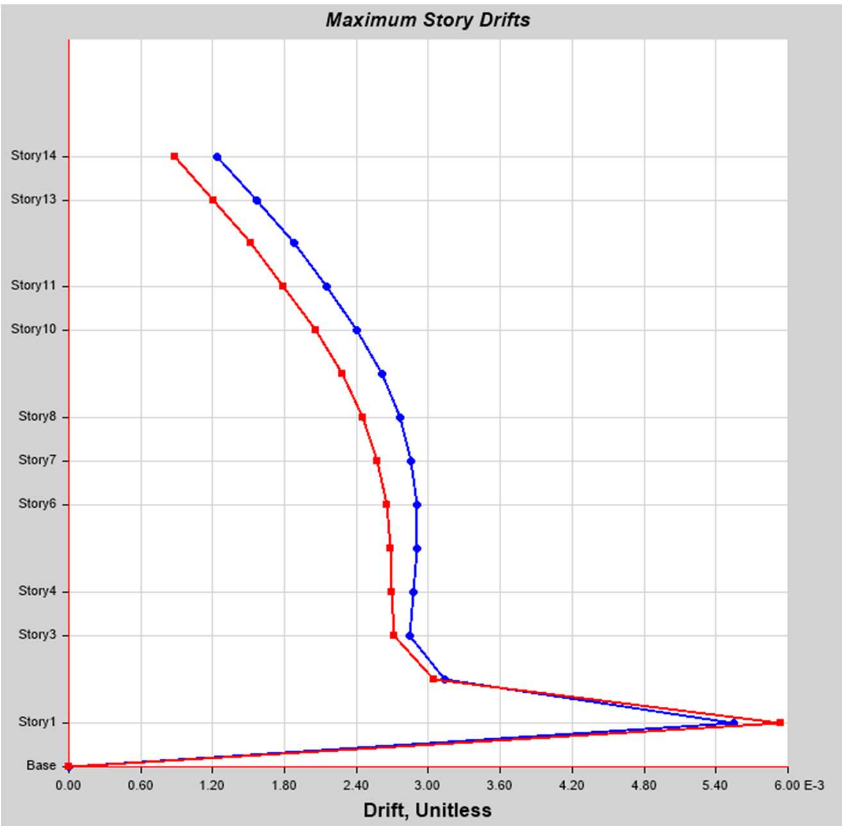


Graph4.6 Comparative maximum Story displacement in Y-direction

4.2 Story drift It is comparable to displacement one floor to different floors above or below. According to IS1893 Part 1-2016 story drift does not beat 0.004 time of compare story height.

Story	Elevation	Location	X-Dir	Y-Dir
	M			
Story14	42	Top	0.00124	0.000881
Story13	39	Top	0.001569	0.001206
Story12	36	Top	0.001877	0.001517
Story11	33	Top	0.002146	0.001792
Story10	30	Top	0.002404	0.002061
Story9	27	Top	0.002612	0.002284
Story8	24	Top	0.002763	0.002454
Story7	21	Top	0.002859	0.002574
Story6	18	Top	0.002904	0.002649
Story5	15	Top	0.002905	0.002685
Story4	12	Top	0.002872	0.002694
Story3	9	Top	0.002849	0.002713
Story2	6	Top	0.003138	0.003045
Story1	3	Top	0.005547	0.005942
Base	0	Top	0	0

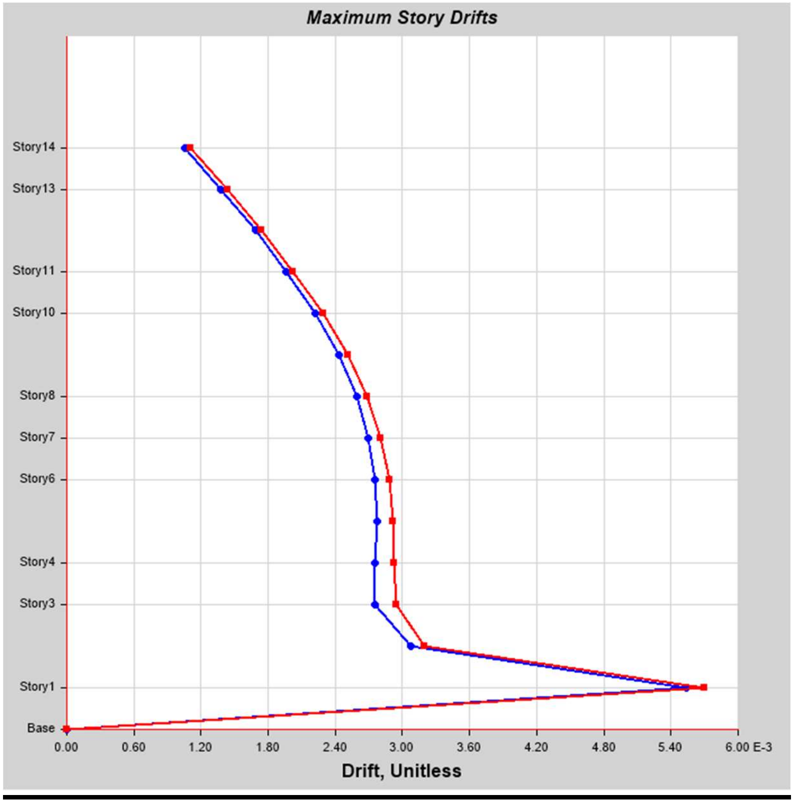
Table4.7 Story drifts of normal building



Graph4.7 Story drifts of normal building

Story	Elevation	Location	X-Dir	Y-Dir
	m			
Story14	42	Top	0.001058	0.00111
Story13	39	Top	0.001378	0.001434
Story12	36	Top	0.001684	0.001743
Story11	33	Top	0.001955	0.002019
Story10	30	Top	0.002216	0.002289
Story9	27	Top	0.00243	0.002512
Story8	24	Top	0.002588	0.002683
Story7	21	Top	0.002695	0.002804
Story6	18	Top	0.002753	0.00288
Story5	15	Top	0.00277	0.002917
Story4	12	Top	0.002756	0.002926
Story3	9	Top	0.002756	0.00294
Story2	6	Top	0.003073	0.003195
Story1	3	Top	0.005536	0.0057
Base	0	Top	0	0

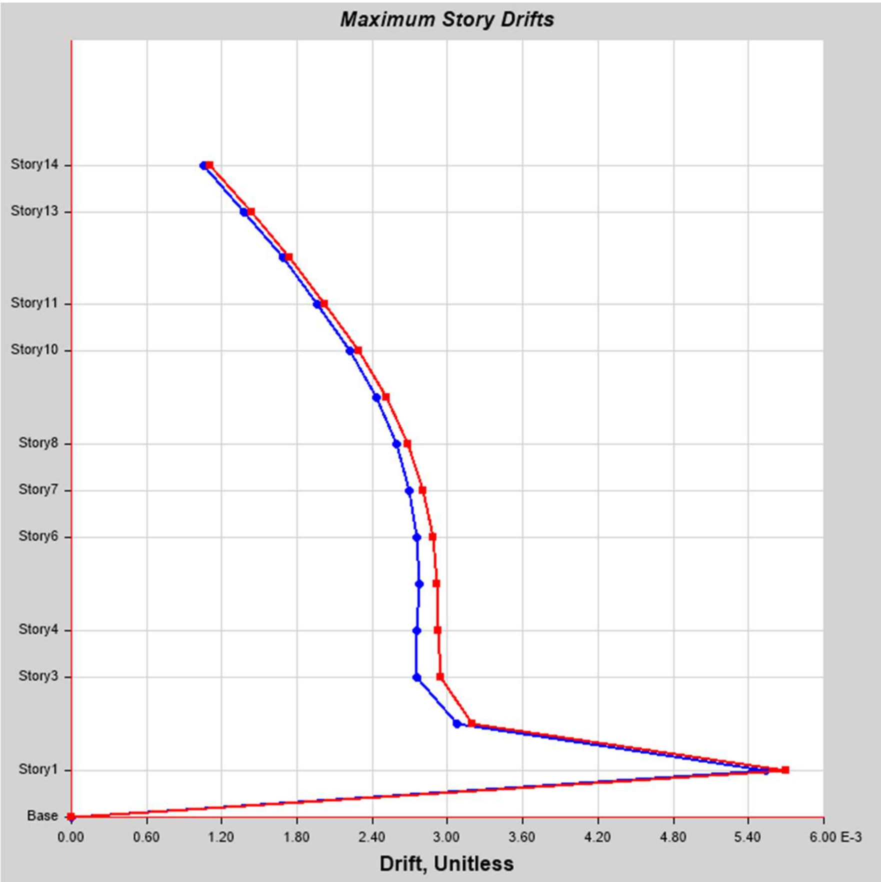
Table4.8 Story drifts of FC at 1st floor



Graph4.8 Story drifts of FC at 1st floor

Story	Elevation	Location	X-Dir	Y-Dir
	m			
Story14	42	Top	0.001133	0.001117
Story13	39	Top	0.001464	0.00145
Story12	36	Top	0.001781	0.001767
Story11	33	Top	0.002061	0.002049
Story10	30	Top	0.002331	0.002324
Story9	27	Top	0.002552	0.002549
Story8	24	Top	0.002716	0.002717
Story7	21	Top	0.002823	0.002792
Story6	18	Top	0.003071	0.002843
Story5	15	Top	0.003065	0.002853
Story4	12	Top	0.003011	0.002833
Story3	9	Top	0.002966	0.002829
Story2	6	Top	0.003243	0.003147
Story1	3	Top	0.005717	0.005786
Base	0	Top	0	0

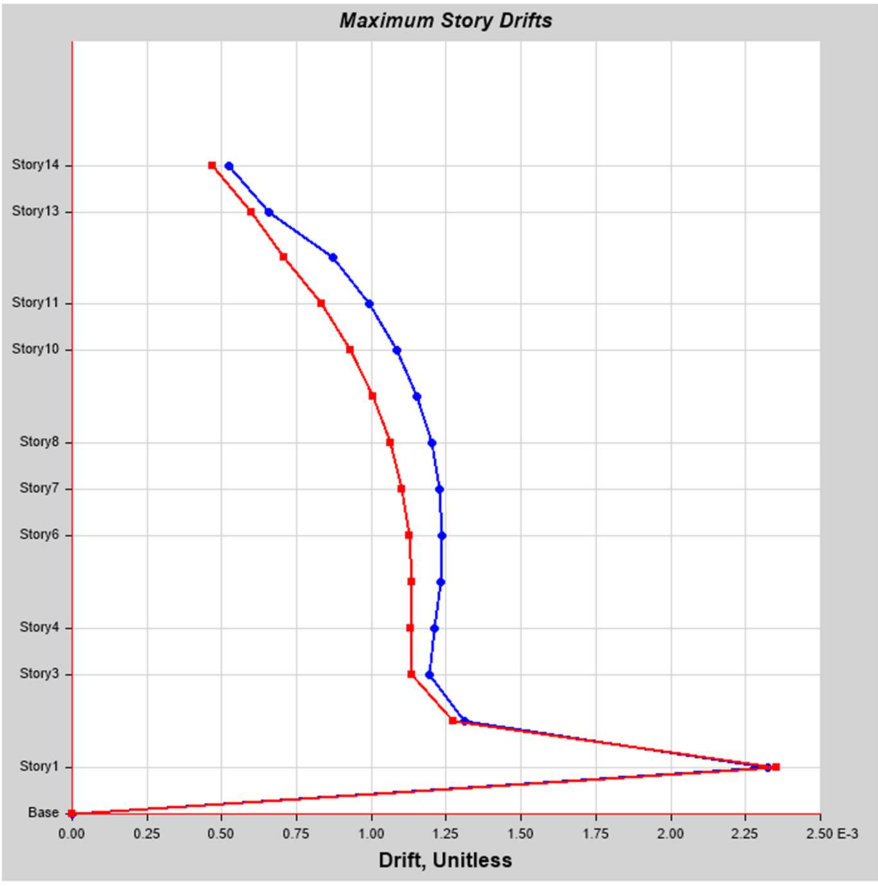
Table4.9 Story drifts of FC at 7th floor



Graph4.9Story displacement of FC at 7th floor

Story	Elevation	Location	X-Dir	Y-Dir
	m			
Story14	42	Top	0.000524	0.000471
Story13	39	Top	0.000657	0.000598
Story12	36	Top	0.00087	0.00071
Story11	33	Top	0.00099	0.000833
Story10	30	Top	0.001085	0.000931
Story9	27	Top	0.001153	0.001007
Story8	24	Top	0.001201	0.001064
Story7	21	Top	0.001228	0.001103
Story6	18	Top	0.001237	0.001125
Story5	15	Top	0.001229	0.001133
Story4	12	Top	0.00121	0.001131
Story3	9	Top	0.001195	0.001136
Story2	6	Top	0.001313	0.001273
Story1	3	Top	0.002324	0.002352
Base	0	Top	0	0

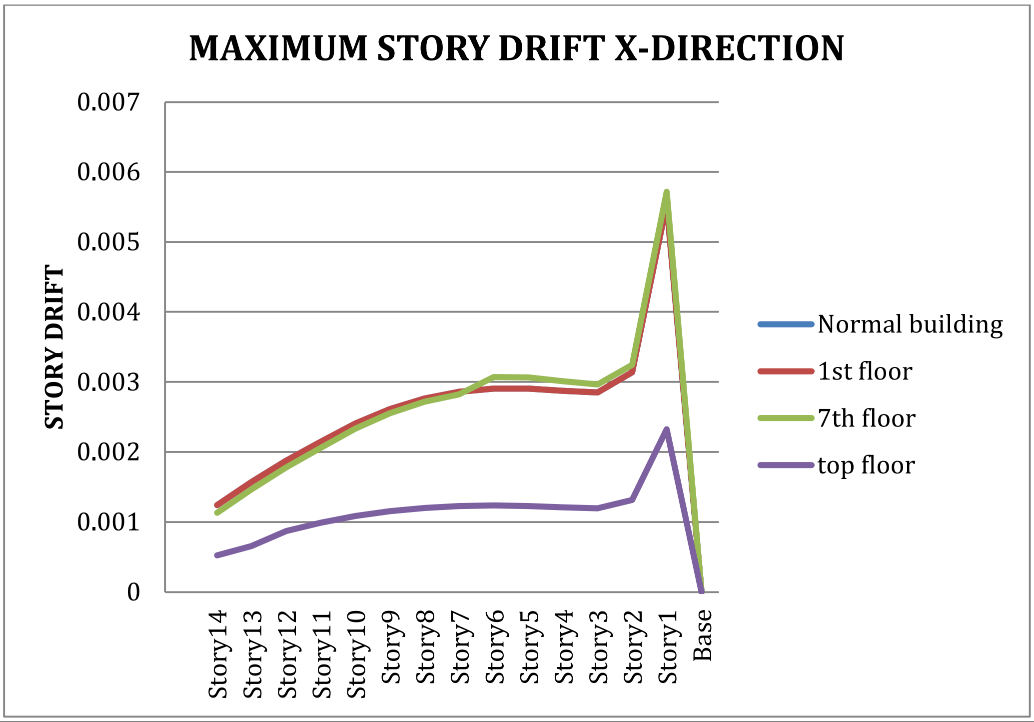
Table4.10 Story drifts of FC at top floor



Graph4.10 Story drifts of FC at top floor

Story	Normal building	1st floor	7th floor	top floor
Story14	0.00124	0.001058	0.001133	0.000524
Story13	0.001569	0.001378	0.001464	0.000657
Story12	0.001877	0.001684	0.001781	0.00087
Story11	0.002146	0.001955	0.002061	0.00099
Story10	0.002404	0.002216	0.002331	0.001085
Story9	0.002612	0.00243	0.002552	0.001153
Story8	0.002763	0.002588	0.002716	0.001201
Story7	0.002859	0.002695	0.002823	0.001228
Story6	0.002904	0.002753	0.003071	0.001237
Story5	0.002905	0.00277	0.003065	0.001229
Story4	0.002872	0.002756	0.003011	0.00121
Story3	0.002849	0.002756	0.002966	0.001195
Story2	0.003138	0.003073	0.003243	0.001313
Story1	0.005547	0.005536	0.005717	0.002324
Base	0	0	0	0

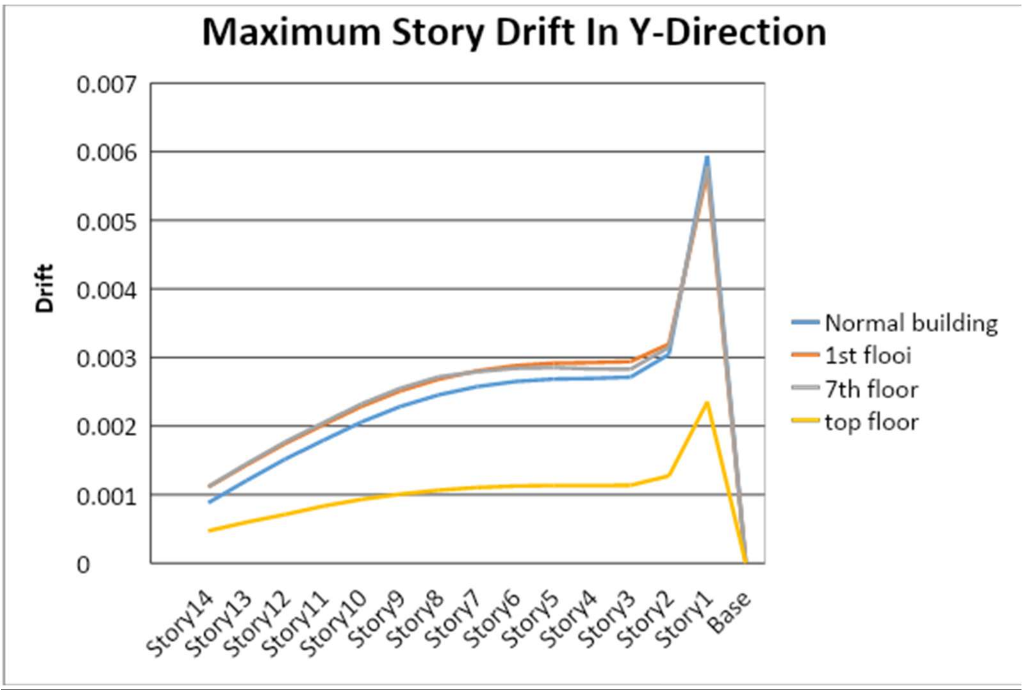
Table4.11 Comparative maximum Story drift in X-direction



Graph4.11 Comparative maximum Story drift in X-direction

Story	Normal building	1st floor	7th floor	top floor
Story14	0.000881	0.00111	0.001117	0.000471
Story13	0.001206	0.001434	0.00145	0.000598
Story12	0.001517	0.001743	0.001767	0.00071
Story11	0.001792	0.002019	0.002049	0.000833
Story10	0.002061	0.002289	0.002324	0.000931
Story9	0.002284	0.002512	0.002549	0.001007
Story8	0.002454	0.002683	0.002717	0.001064
Story7	0.002574	0.002804	0.002792	0.001103
Story6	0.002649	0.00288	0.002843	0.001125
Story5	0.002685	0.002917	0.002853	0.001133
Story4	0.002694	0.002926	0.002833	0.001131
Story3	0.002713	0.00294	0.002829	0.001136
Story2	0.003045	0.003195	0.003147	0.001273
Story1	0.005942	0.0057	0.005786	0.002352
Base	0	0	0	0

Table4.12 Comparative maximum Story drift in Y-direction

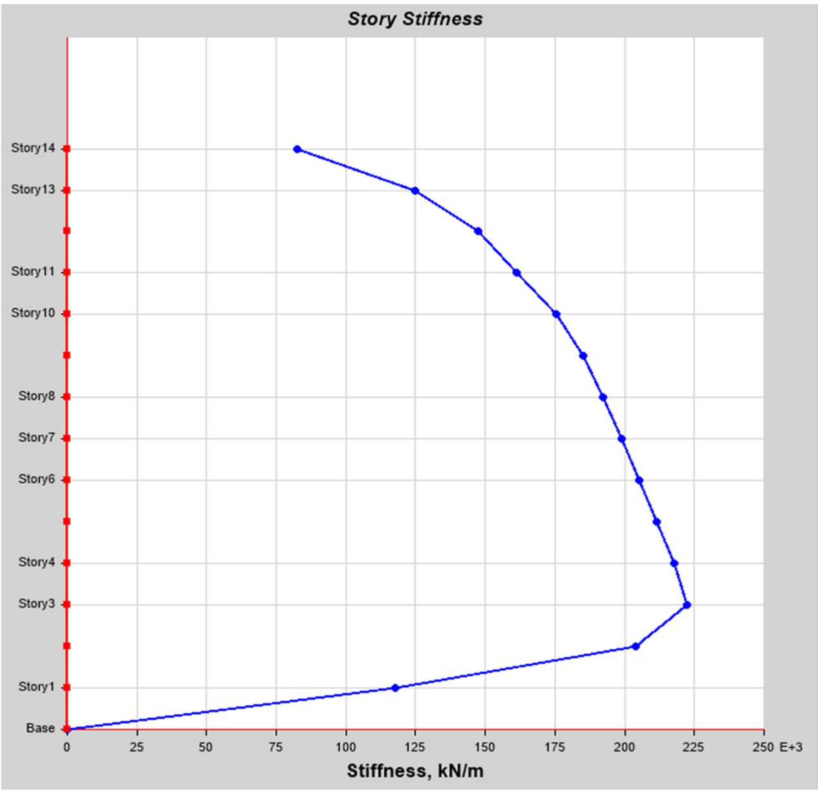


Graph4.12 Comparative maximum Story drift in Y-direction

4.3 Stiffness means the extent to which the element is able to resist deformation or deflation under the action of an applied force.

Story	Elevation	Location	X-Dir	Y-Dir
	m		kN/m	kN/m
Story14	42	Top	84055.554	134487.27
Story13	39	Top	130149.02	183125.76
Story12	36	Top	152827.21	203582.53
Story11	33	Top	166178.09	213792.4
Story10	30	Top	180373.81	225690.1
Story9	27	Top	189824.75	232663.5
Story8	24	Top	197286.1	237900.44
Story7	21	Top	203860.77	242392.49
Story6	18	Top	210195.8	246642.3
Story5	15	Top	216729.4	250939.58
Story4	12	Top	223433.47	255080.07
Story3	9	Top	227681.8	255732.6
Story2	6	Top	208141.84	229740.12
Story1	3	Top	118480.75	119671.72
Base	0	Top	0	0

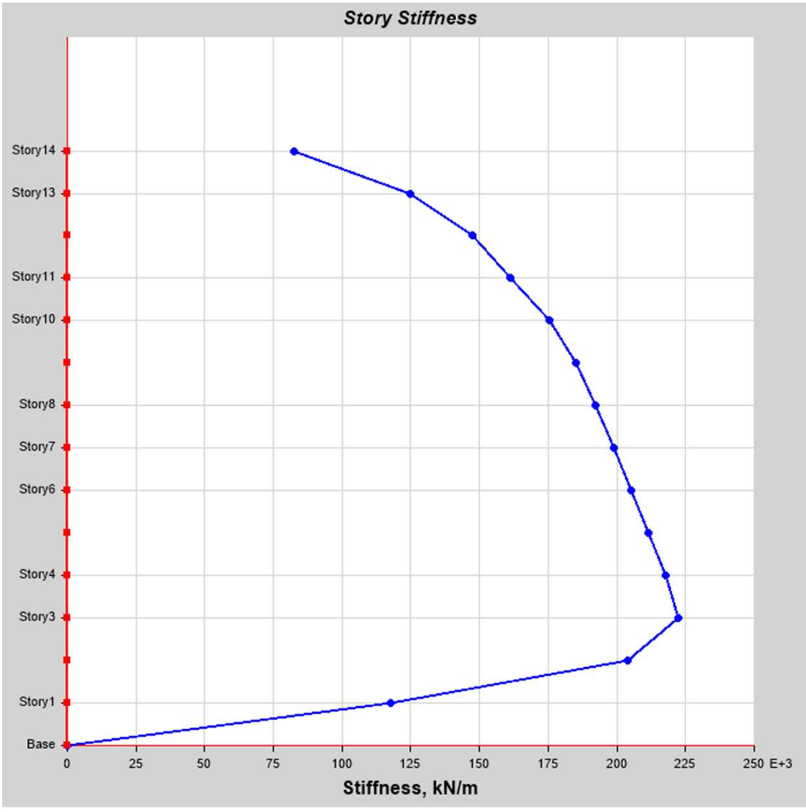
Table4.13 Stiffness of normal building



Graph4.13 Stiffness of normal building

Story	Elevation	Location	X-Dir	Y-Dir
	m		kN/m	kN/m
Story14	42	Top	82492.409	134180.14
Story13	39	Top	124748.07	182530.32
Story12	36	Top	147468.57	203070.07
Story11	33	Top	161034.09	213353.17
Story10	30	Top	175343.26	225310.33
Story9	27	Top	184909.53	232334.31
Story8	24	Top	192410.36	237616.26
Story7	21	Top	198939.06	242151.44
Story6	18	Top	205139.37	246447.31
Story5	15	Top	211450.56	250808.32
Story4	12	Top	217911.73	255063.43
Story3	9	Top	222472.3	256664.86
Story2	6	Top	204139.91	222656.54
Story1	3	Top	117630.13	123739.69
Base	0	Top	0	0

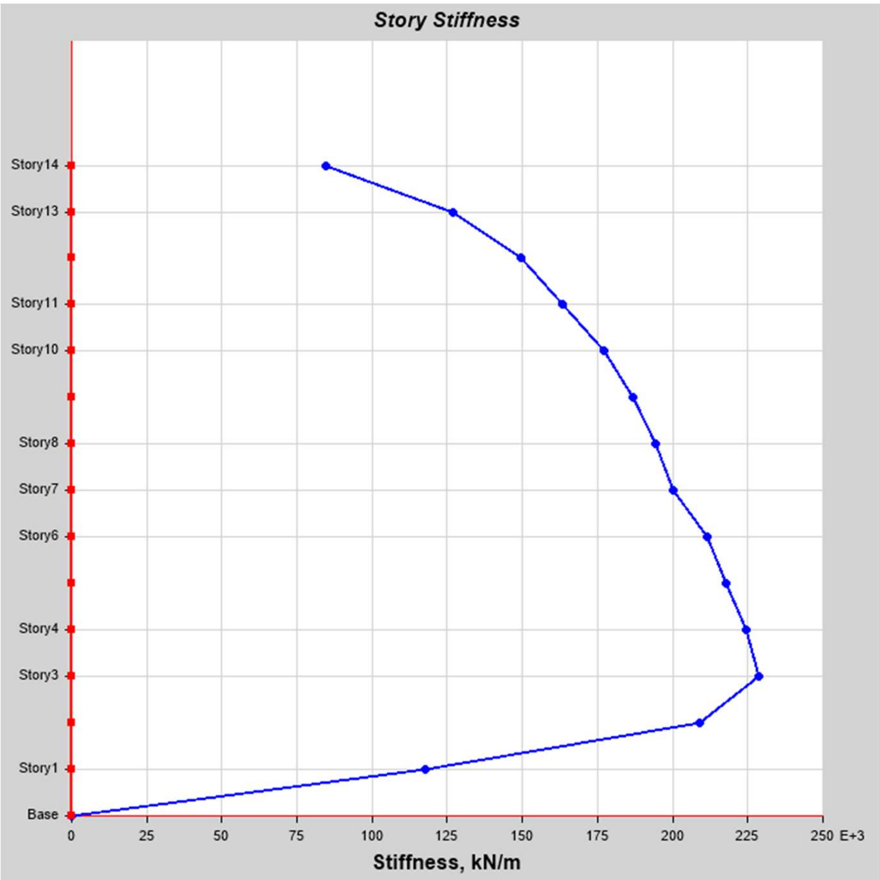
Table4.14 Stiffness of FC at 1st floor



Graph4.14 Stiffness of FC at 1st floor

Story	Elevation	Location	X-Dir	Y-Dir
	m		kN/m	kN/m
Story14	42	Top	85027.714	131452.38
Story13	39	Top	131984.35	181157.39
Story12	36	Top	157332.7	206905.45
Story11	33	Top	172253.73	218893.7
Story10	30	Top	182633.67	226764.14
Story9	27	Top	190635.54	232579.59
Story8	24	Top	197408.13	237347.71
Story7	21	Top	203661.02	241647.14
Story6	18	Top	209895.41	245852.57
Story5	15	Top	216479.86	250201.2
Story4	12	Top	223349.36	254443.52
Story3	9	Top	227891.31	255521.29
Story2	6	Top	208543.05	229468
Story1	3	Top	117682.07	123938.11
Base	0	Top	0	0

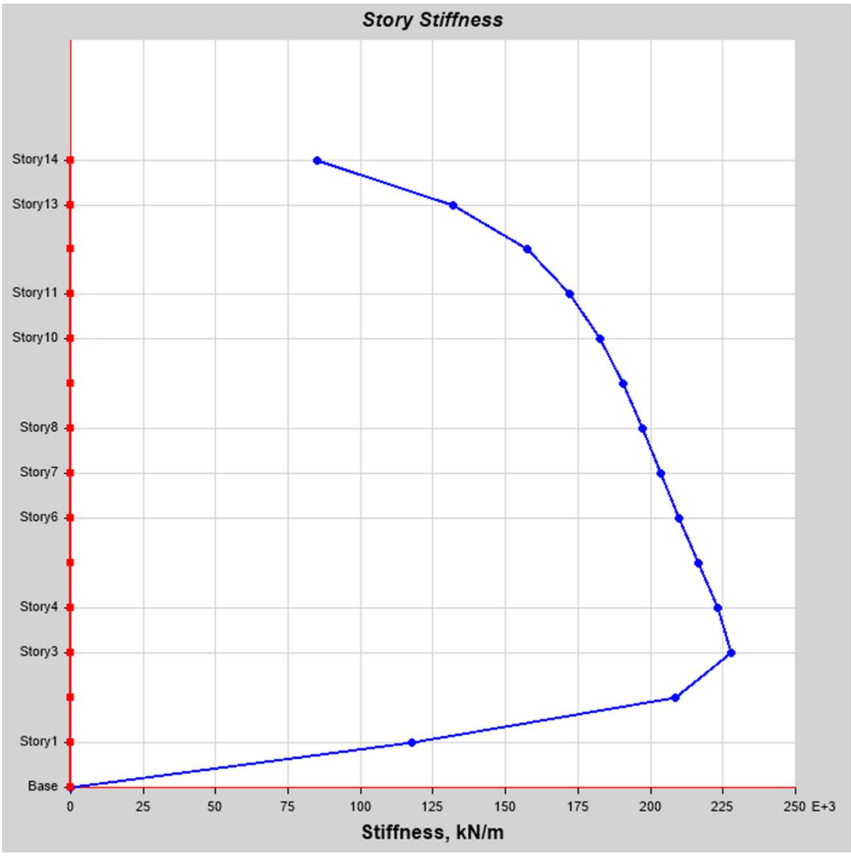
Table4.15 Stiffness of FC at 7th floor



Graph4.14 Stiffness of FC at 7th floor

Story	Elevation	Location	X-Dir	Y-Dir
	m		kN/m	kN/m
Story14	42	Top	84397.643	134570.36
Story13	39	Top	126968.45	182832.2
Story12	36	Top	149660.09	203340.39
Story11	33	Top	163177.31	213685.45
Story10	30	Top	177232.75	225446.2
Story9	27	Top	186697.06	232476.35
Story8	24	Top	194352.07	238253.97
Story7	21	Top	200260.52	234778.31
Story6	18	Top	211395.88	246285.56
Story5	15	Top	217698.8	250579.51
Story4	12	Top	224403.13	254886.48
Story3	9	Top	228695.51	255869.66
Story2	6	Top	208983.53	229663.16
Story1	3	Top	117772.84	123973.33
Base	0	Top	0	0

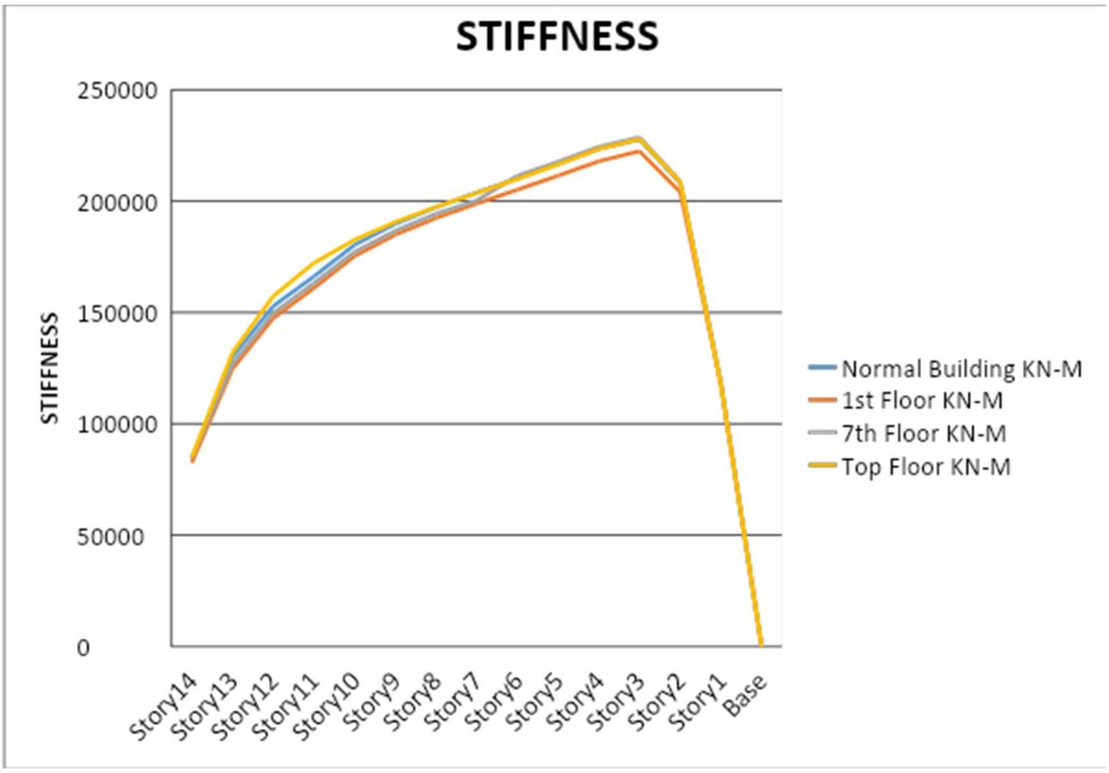
Table4.16 Stiffness of FC at top floor



Graph4.16 Stiffness of FC at top floor

Story	Normal Building	1st Floor	7th Floor	Top Floor
	KN-M	KN-M	KN-M	KN-M
Story14	84055.554	82492.409	84397.643	85027.714
Story13	130149.02	124748.07	126968.45	131984.35
Story12	152827.21	147468.57	149660.09	157332.7
Story11	166178.09	161034.09	163177.31	172253.73
Story10	180373.81	175343.26	177232.75	182633.67
Story9	189824.75	184909.53	186697.06	190635.54
Story8	197286.1	192410.36	194352.07	197408.13
Story7	203860.77	198939.06	200260.52	203661.02
Story6	210195.8	205139.37	211395.88	209895.41
Story5	216729.4	211450.56	217698.8	216479.86
Story4	223433.47	217911.73	224403.13	223349.36
Story3	227681.8	222472.3	228695.51	227891.31
Story2	208141.84	204139.91	208983.53	208543.05
Story1	118480.75	117630.13	117772.84	117682.07
Base	0	0	0	0

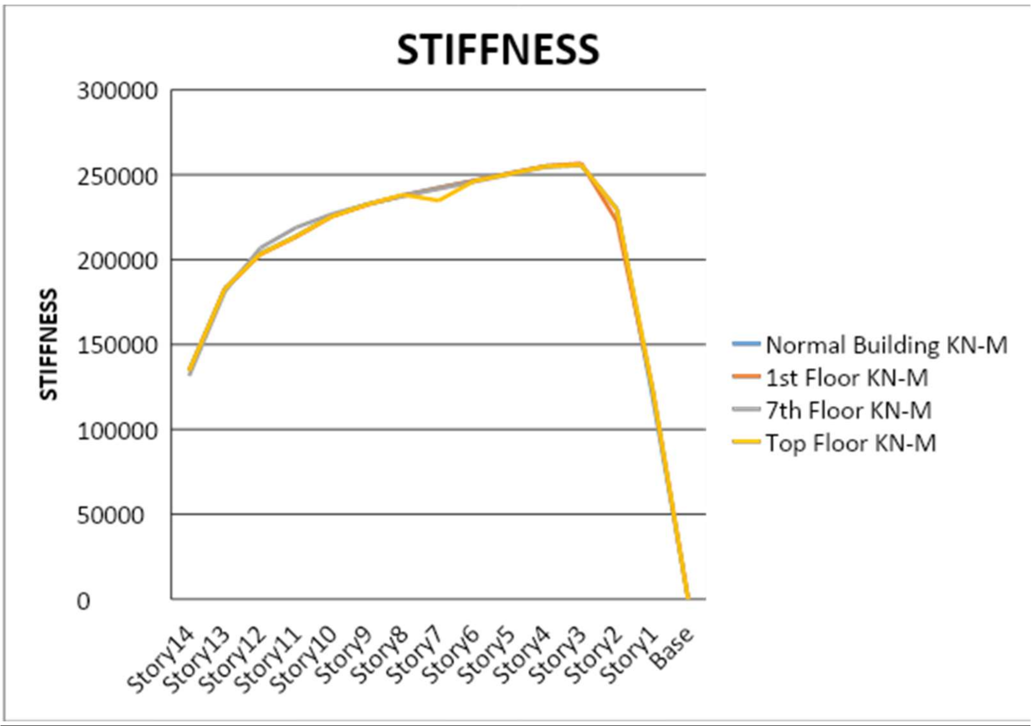
Tabel4.17 Comparative maximum Stiffness in X-direction



Graph4.17 Comparative maximum Stiffness in X-direction

Story	Normal Building	1st Floor	7th Floor	Top Floor
	KN-M	KN-M	KN-M	KN-M
Story14	134787.27	134180.14	131452.38	134570.36
Story13	183125.76	182530.32	181157.39	182832.2
Story12	203582.53	203070.07	206905.45	203340.39
Story11	213792.4	213353.17	218893.7	213685.45
Story10	225690.1	225310.33	226764.14	225446.2
Story9	232663.5	232334.31	232579.59	232476.35
Story8	237900.44	237616.26	237347.71	238253.97
Story7	242392.49	242151.44	241647.14	234778.31
Story6	246642.3	246447.31	245852.57	246285.56
Story5	250939.58	250808.32	250201.2	250579.51
Story4	255080.07	255063.43	254443.52	254886.48
Story3	255732.6	256664.86	255521.29	255869.66
Story2	229740.12	222656.54	229468	229663.16
Story1	119671.72	123739.69	123938.11	123973.33
Base	0	0	0	0

Tabel4.18 Comparative maximum Stiffness in Y-direction

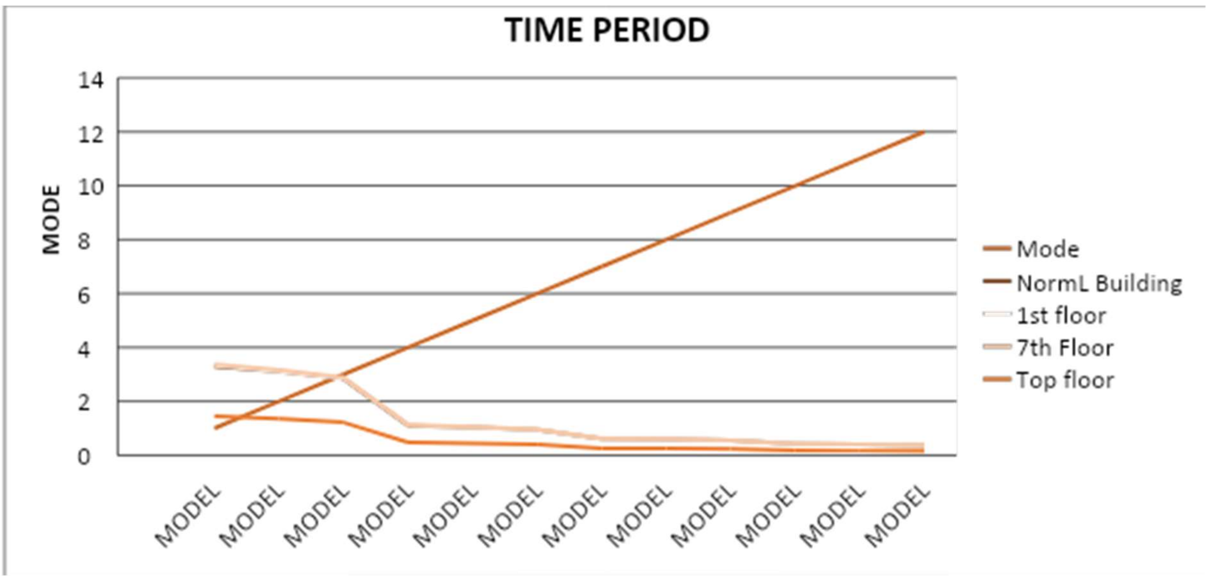


Graph4.18 Comparative maximum Stiffness in Y-direction

4.4 Time period Time period is the time taken for one complete circle of vibration pass a given time.

Case	Mode	Normal Building	1st floor	7th Floor	Top floor
MODEL	1	3.294	3.328	3.374	1.441
MODEL	2	3.112	3.104	3.17	1.352
MODEL	3	2.841	2.846	2.888	1.219
MODEL	4	1.103	1.11	1.138	0.473
MODEL	5	1.04	1.038	1.06	0.445
MODEL	6	0.942	0.942	0.96	0.399
MODEL	7	0.61	0.611	0.626	0.258
MODEL	8	0.591	0.59	0.603	0.249
MODEL	9	0.549	0.548	0.559	0.228
MODEL	10	0.414	0.415	0.423	0.175
MODEL	11	0.404	0.403	0.411	0.17
MODEL	12	0.375	0.375	0.382	0.157

Tabel4.19 Comparative time period

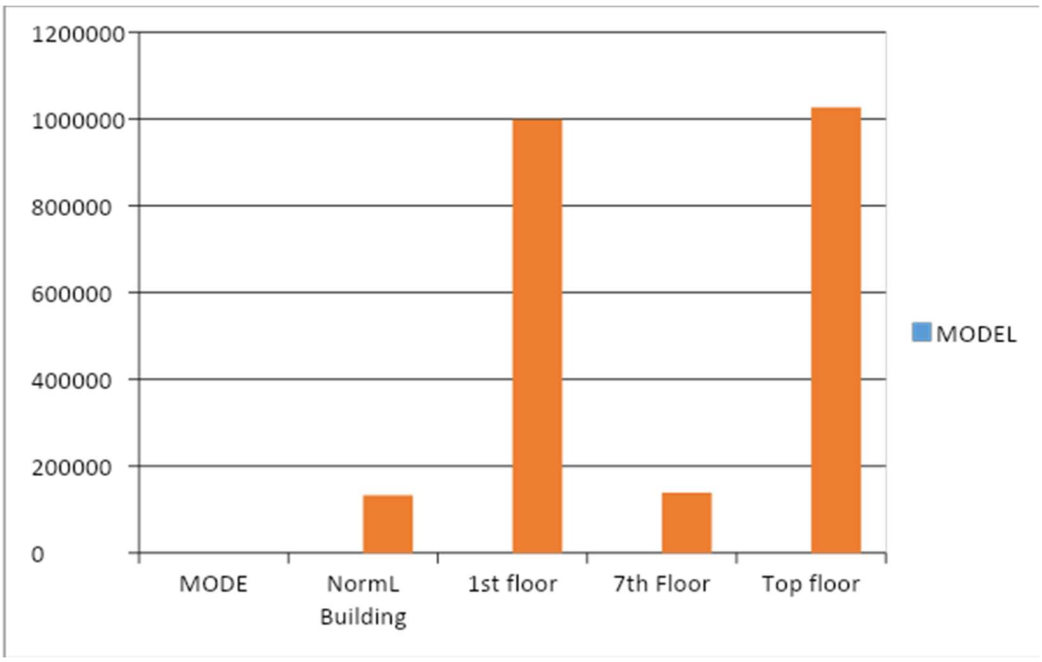


Graph4.19 Comparative time period

4.5 Base shear Base shear is evaluation of the maximum expected lateral force on the base of structure due to seismic activity.

CASE	MODE	Normal Building	1st floor	7th Floor	Top floor
MODEL	1	133175.6034	998712.502	138843.51	1026869.55

Tabel4.20 Comparative Base shear



Graph4.20 Comparative Base shear

CHAPTER-5

CONCLUSION

1. CONCLUSION

From the above study and result some conclusion can be figure out which is as fallow.

1. Drift and displacement are decreasing in buildings with floating columns as compared to buildings without floating columns.
2. Floating column at the top floor is more efficient and good result compared with other buildings for drift.
3. Floating column at the top floor is show good result for building safety compared with other buildings for story displacement.
4. Time period reduced with floating column. The building with a floating column at top floor is good in terms of time period; it gives the minimum value of time period as compression of other buildings in the model.
5. Story stiffness is more effective compared to other buildings with floating columns.
6. Finally, in looking of the result of base shear we found that the building which is floating column at top floor show maximum base shear compare to other three structure and this is good result for the safety of building.
7. The comparison of a normal building with a floating column at 1st floor, 7th floor, top floor.
8. Ultimately the comparing these four structure normal RC frame building, floating column at 1st floor, floating column at 7th floor and floating column at top floor in parameter story displacement, story drift, stiffness, base shear, time period we found that the floating column at top floor is most efficient building and good in result for future purpose and public safety.

REFERANCE

1. Deekshita R., Dr. H. S. SureshchamdraDy (2017) "Seismic analysis of multi-story building with and without column"

2. Snehal Ashok Bhoyar (2017)"Effect of floating column on building performance subjected to lateral load", Volume1, Issu2, ISSN:2456-8465, pp134-143**"**

3. Mohammed Mustafa (2017) "seismic analysis of multi-storey building with floating column"

4. Jayashri Sarode, Mr. Anmol S. (2016)"Analysis pf floating column building of composite and RCC beam girder and compression with RCC frame structure. V9.7.0" ISSN:2348-5407, pp-291469.

5. Karishma I. Patel (2016) "Seismic analysis of multi-story building with and without column in seismic zone"

6. Nakul A. Patil, Riyaz Sameer Shah (2016)"Comparative study of and non-floating column with and without seismic behaviour". V2. ISSN2455-263, pp29-33

7. S. B. Waykulee (2016) "Study of behaviour of floating column for seismic analysis of multi-storey building". V7, ISSN:0976-6308, pp676-685.

8. Kadam S. S. Lale S. V. (2016)"Review of study of behaviour of floating column for seismic analysis of floating column. International Journal of Engineering and Applied Science and Technology. V1. ISSN 2455-2143.

9. Ms. Priyanka, D. Mothgare (2016)"Numerical studies of RCC frame with different position of floating column. Technical Research Organization India." V2. ISSN 2395-7786.

10. Sharma R. K. (2016)"Dynamic analysis of RCC frame structure with floating column. International Journal of Advance Research and Science Engineering and Technology. V3, ISSN2350-0328.

11. Gangadari Vishal Kumar (2016) "seismic analysis of multi-storey building with floating column".

12. Badgireudhav S. (2015) "Analysis of multi-storey building with floating column", V4. ISSN.2319-6890, pp475-487.

13. Keerthi Godwa B. S, Syed Tajoddeen (2014)"seismic analysis of multi-storey building with floating column". pp528-535.

14. Sriknath M. K., Yogendra (2014)"Seismic response of complex building with floating column for zone 2 and zone 5. V2, ISSN 2321-7785.

15. Shivam tyagi (2014) "seismic analysis of multi-storey building with floating column."

16. Kishalay Maitra. (2014) "Evolution of seismic performance of building with floating column."

17. Mundda. S. G. Sawadakar (2014) "Comparative seismic analysis of the multi-storey building with and without floating column, International Journal of Current Engineering and Technology.

18. Susanta Banerjee, Sanjay kuamr patra (2014) "Estimate of park-Ang damage index of floating column building with infill wall. 55th Annual journal of Orissa state center , Institute of engineering India (2014)"

19. Peera Nautiyal, Saleem akter (2014) "Seismic response evaluation of RC frame building with floating column considering different soil. International Journal of Current Engineering and Technology.

20. Sreeknath Gandala, Pradeep kumar (2014) "seismic analysis of multi-storey building with floating column"

21. IS:1893(part1):2016 Criteria for earthquake resistance design of structure

22. IS:456:2000 plan and reinforcement concrete

APPINDIX