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Seismic Performance of Structure with Floating Column

Vishwanth T. Kambale[1]* V. S. Kshirsagar[2] A. B. Kokare[3] Manik Deshmukh[4]

[1,2,3,4] Department of Civil Engineering, SVERI'S Collage of Engineering, Pandharpur, India

Abstract – A column is a straight-mounted element that starts from the ground and transfers various loads to the foundation. Similarly, floating columns are direct entities that are fixed units at the lower level of the support, called the fixed section. There are a number of planned projects that use fluting columns; especially the ground and beam.to provide additional free space on the ground floor SAP2000 software is used to perform the exam of the generally constructed structures. Modal have a look at, reaction spectrum research and time history study are completed on numerous organized fashions by changing the position of the floating column from first ground to top floor. In a response spectrum case, for a given route of acceleration, the maximum forces, stresses, and displacements were calculated at some point of the shape for each and every mode of the vibration. These modal results for a given response amount are mixed to yield a unmarried, wonderful outcome for the given specific path of acceleration using someone of the modal mixture processes. The effects are calculated and an evaluation is made amongst this model.

Keywords – Earthquake Loading, Floating Column, Model Analysis, Response Spectrum Analysis, Sap 2000 etc.

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1. INTRODUCTION

Open base floors are an integral part of skyscrapers in most cities under construction in India today. The reception lobby or parking space on the ground floor is usually supported. However, the foundation used by the structure in an earthquake depends on the natural length of the building, and the distribution of seismic force depends on the height, rigidity and distribution of the assembly. The behavior of the structure during an earthquake depends on the overall size, shape and shape, depending on how the seismic force (earthquake) base is transferred. The forces of earthquakes coming at different heights on the floor of a building have to be attributed to the foundation in the downward path. An eccentric structure is then formed as result of eccentricity, deviation, or abundance in the path of this transition. Vertical barrier structures, such as sink halls in restaurant and hotel buildings, where some floors are much larger than others, because sudden changes in the intensity of an earthquake on its surface or on cracked floors. Extremely desolate columns or walled structures on a particular floor, or unusually high or bankrupt walls can cause damage or loss from that particular floor. When the Bozi earthquake hit Gujarat in 2001, some of the skyscrapers with exposed ground floors or ground floors for parking were renovated or strongly rejected. Building with pillars hanging on the main beam

1.2 Floating Column

A column is a straight-mounted element that starts from the ground and transfers various loads to the foundation. Similarly, floating columns are direct entities that are fixed units (depending on the location / architectural appearance) at the lower level (edge) of the support, called the fixed section. The girder or beam will eventually transfer the load to other direct components such as the column below. There are a number of planned projects that use floting columns, especially the ground and beam.to provide additional free space on the ground floor. These open spaces may be required for assembly, meeting room or parking purposes. Gear carriers need to be designed accordingly, especially in sesmic areas. The beam point load supporting the column __For research, the columns are often kept at the base level and therefore reserved for the static load of the transition beam. You can test such frameworks using software such as ETABS, STAAD Pro, and SAP2000. Suspended columns are strong and durable enough to withstand gravity loads, but the beam are basically in the correct propertions. In other words, it is a sufficient stiffness value that the deflection is almost negligible. In advanced stages of progress, people still prefer to build houses. However, this requirement should not be created at the expense of evasion response operations and structural seismic

protection. Architectural structures that damage the response of the structure should be as minimal as possible. When the construction has irregular structural features, it is important to employ a high level of structural engineering As planned,but the building structures are not decent with common feature.

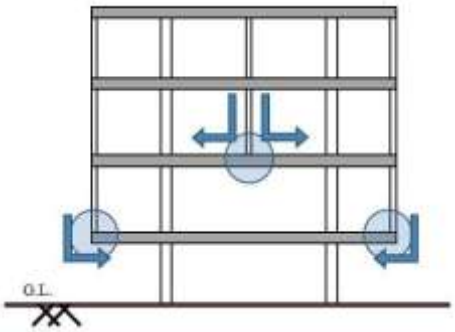

Figure 1: - Floating Column

Therefore, assemblies built on dissatisfied and disgruntled partners are at risk in the seismic zone. However, these structures cannot be destroyed, but training and some other reaction methods can be suggested to strengthen the assembly of such building structures. You can increase your first starting column or ground column. This can be improved by modifying the stiffness of the position on the first floor. Alternatively, it can be used in rapid braking structures to reduce structural deflection. it is.

2. LITERATURE REVIEW

The numerous literatures were referred from journals, preceding, books and many others to apprehend gift popularity of task undertaken. From this literature information is summarized for work. These are defined below. Udhav B, et al (2015)[1] “In his analysis of a multi-storey floating column building, he examined the behavior of an existing structure, which was a G10 residential building. Several building models were developed using the Stadpro software and this analysis was performed using the static method. ... A structured structure model contains all modules that affect the mass, instability, stiffness, and ultimately the resistance of the structure. The results show that the displacement of the column varies depending on the state and location, the rotation on each floor or floor also increases, and the lateral force increases gradually, but for the respective columns it is almost the same on each floor. Rehman A. (2015) [2] Impact of coasting sections on seismic reaction of multi-storeyed RC outlined structures Use response spectrum method for dynamic and static analysis.for elevated G + 6-storey building by fluctuating floating column floor-wise space. It has been observed that starting a floating column in the RC building increases with time and is usually caused by a decrease in stiffness. It also reduces the original response and spectral acceleration. Ms. Waykule S.B, et al (2016)[3] For seismic analysis of multi-story concrete buildings In their study of the effect of floating columns in extreme seismic insurance, the building was analyzed and the space of the floating columns evaluated in 4 models. Linear static and time history were analyzed in all four models and the results were compared with each other. From the analysis of the history of the time, the response of the 4 models was planned. In this work, they conclude that floating column lume with dynamic response and results in different conditions of the building have more floors than traditional floating column lum. Mohamed Aqeeb Ulla,et.al (2016) [4] Seismic evaluation of RC homes with floating columns the usage of non linear static evaluation taking into account the floating columns. With the help of a nonlinear analysis method, the model directly integrates the force and stress characteristics of different parts of the structure and base and leads to undesirable physical behavior and behavior. Several models for nonlinear responses were generated and analyzed. He concluded that the total impedance capacity of the building depends entirely on the applied forces and the shear capacity of the base. It is assumed that the ground shear depends on the mass of the structural specimen. Shah P. (2016) [5] concentrated on Seismic Investigation of RCC working with and without gliding segments. They study the reaction of drifting segment to the seismic powers and furthermore study the frail basic individuals from the design having gliding section. T. Chandra Shekhar. (2016) [6] Thought about Seismic examination of a gliding segment building and an ordinary structure utilizing ETABS-2013. In this a private structure with 6 Stories and 12 Story are broke down with segments, Shafts and Pieces. The structures are examined and planned with and without edge sections at base story. The structures are examined in two Quake zones with medium soil Sasidhar T, et al (2017) [7] The program analyzed buildings using ETABS. They discussed the removal of columns in the G + 5 apartment building and different issues in different situations and on different floors of the apartment building. Equivalent analysis is done on the mathematical model and the results are compared to or compared to the current building model. Arpit Shrivastav (2018) [8] the conduct of multistorey structures having drifting segments under seismic powers and notice the impact of shear divider in a similar structure. For this reason three instances of multi-story structures are considered having 8 story, 12 story and 16 story. For every one of the cases considered float esteems chase after comparable way along story stature with greatest worth lying some place close about the center story. For every one of the models considered dislodging values chase after comparative steadily expanding straight way along story tallness.

2.1. Objectives of work

1. To study the performance of floating column and non-floating column with seismic performance.

2. To find out the effect of floating columns in the building on column support and non-column support.

3. To study of the flow and variation of forces in different positions of the building in different locations of floating column floors.

4. Design a floating column working to improve the overall seismic performance of the structure.

3. METHODOLOGY

1. Modeling of floating column using SAP2000.

2. Dynamic response spectrum analysis (RSA) using SAP2000.

3.1 Dynamic Analysis

Dynamic examination is a segment of breaking down structure which considers the adaptable versatile primary conduct when a powerful burden is acting. Burden which is dynamic in nature constantly changes with time. Dynamic burden incorporates the breeze, tremor load, live load and so forth Along these lines, basically all practical challenges can be inspected progressively. For the most part, these heaps fluctuate continuously and the general reaction of the design conceivably will be approximated by a static-strategy wherein inactivity powers are probably going to be disregarded. Be that as it may, if the heap esteems change quickly, the reaction should have been determined with the utilization of dynamic assessment in which inertial power can't be dismissed which is identical to mass occasions speed increase (second law of movement).

Numerically,

f = m x a

Where, f = power of inactivity,

m = mass(inertial), and

a = speed increase.

In addition, stresses and relocations are for the most part a lot more prominent in examination with the comparable static developments for indistinguishable abundancy input, explicitly at the full circumstances of construction.

The sensible designs have various relocations. Along these lines, the best basic piece of underlying examination is to create a common automated model, comprising less individuals, fixed amount of masses and restricted amount of relocations of different hubs which thus administers the real conduct of structures or some other constructions. One more risky piece of dynamic construction examination is to gauge dissemination measure of energy also, the limit condition. Likewise, it is interesting to break down structure for seismic burdens also, wind loads. The happened troubles can be limited by methods for different progressed program configuration rehearses.

3.1.2 Response Spectrum Analysis

Reaction range examination is a unique direct arithmetical investigation measure which find out the inclusion from singular common methods for quake to propose the expected greatest or extraordinary seismic tremor reaction of an essentially or principally adaptable get together. Reaction range approach presents a suggestion into dynamic execution by computing pseudo unearthly speed, speed increase, or pseudo-relocation regarding primary period for given time-history. The measure of damping may fluctuate for particular structures. It is functional, to envelope reaction spectra to such an extent that a smooth or level bend implies the most elevated reaction for every single acknowledgment of primary time-frame. RSA is valuable for plan strategy determination since it analyzes actual sort grouping with dynamic demonstration. Constructions of minor period practice bigger speed increase, while those of higher period practice greater relocation. Underlying execution points ought to be considered during unique plan and reaction range examination of the construction.

In a reaction range case, for a provided guidance of speed increase, the greatest powers, stresses, and removals were determined all through the construction for every single method of the vibration. These modular outcomes for a given reaction sum are joined to yield a solitary, positive result for the provided specific guidance of speed increase utilizing any of the modular blend strategies. When a reaction range case is added to a heap mix, it is changed over into a twofold esteemed mix, one with all the positive qualities and other with the negative qualities, for the range results. When distorted shape is appeared for a multi-esteemed burden mix, it depends on the base or then again most extreme relocation at each and singular level of opportunity, whichever has the higher supreme worth. Contingent upon the indication of the strengthening loads considered in the mix of burdens, the resultant uprooting can be in either the negative bearing or the positive way, in any event, for the nearby joints in a construction. Base responses of reaction range won't coordinate with the summation of separate joint responses as a result of the variety in their definitions. Base responses were decided for each and every mode before modes were joined by methods for the SRSS or then again CQC modular mix. Different joint responses, then again, were registered utilizing distinctive diverse modular mixes which were applied to all individual joints.

3.2 Time History Analysis

Time history (straight) examination overpowers every one of the inadequacies of modular range study, however long non-straight conduct of constructions isn't getting looked at. The strategy requires bigger conspiring and figuring endeavors for deciding the reaction at particular time stretches. One energizing advantage of this sort of method is that the near indications of reaction possibilities are all around kept up in the different reaction chronicles. It assumes an imperative part uniquely during the inclusion of cooperation properties in plan between different pressure vectors.

4. MODELING AND ANALYSIS OF STRUCTURE

The building is modelled using the software sap2000. The plan of building is shown in figure 1.

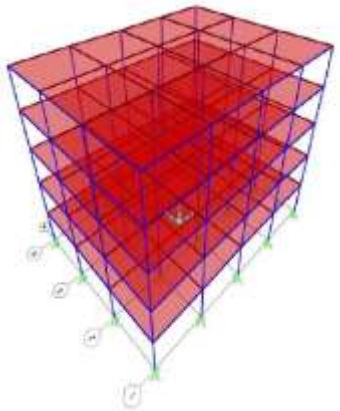

Figure 2: 3D perspective of model

In present work following cases are considered

Building without FC (Model-1)

Building with FC at 1st Floor (Model-2)

Building with FC at 2nd Floor (Model-3)

Building with FC at 3rd Floor (Model-4)

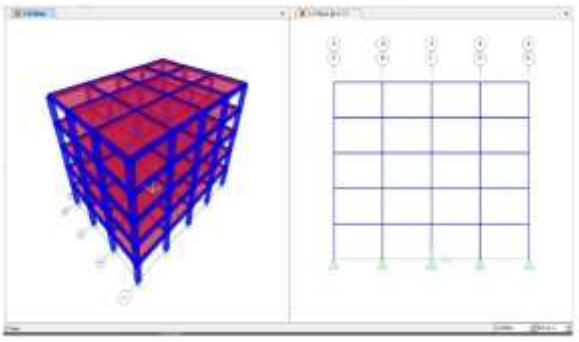

Figure 3: Building without FC (Model-1)

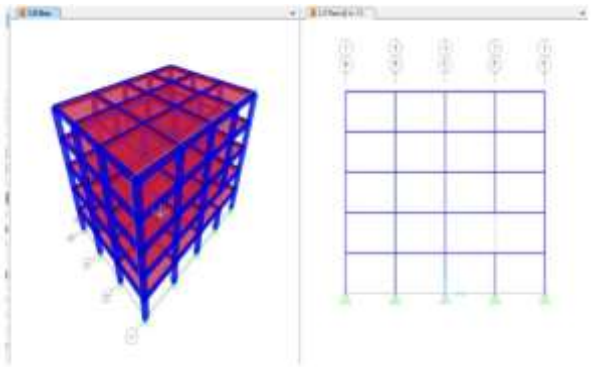

Figure. 4: Building with FC at 1st Floor (Model-2)

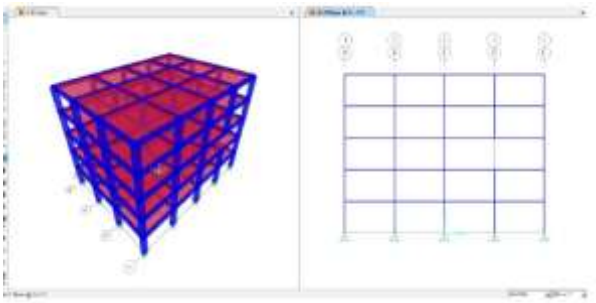

Figure.5: Building with FC at 2nd Floor (Model-3)

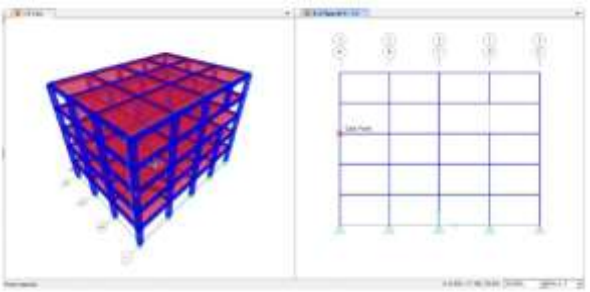

Figure.6: Building with FC at 3rd Floor (Model-4)

5. RESULTS AND DISCUSSIONS

In present examination, assessment and correlation of seismic reaction boundary like time period, story displacements, base shear, and dynamic reaction are finished by changing the position of floating column level wise or floor wise by utilizing straight static examination. Result are related in plain structure and further more charts are ready for the examination of building models with and without floating column

Table 1: - Time Period (in sec) for different models

Mode	Building without FC (model1)	Building with FC at 1st Floor (model2)	Building with FC at 2nd Floor (model3)	Building with FC at 3rd Floor (model4)
1	1.330	1.344	1.340	1.338
2	1.232	1.237	1.234	1.232
3	1.280	1.132	1.129	1.127
4	0.381	0.386	0.386	0.385
5	0.346	0.347	0.347	0.348
6	0.318	0.319	0.320	0.320
7	0.193	0.199	0.201	0.201
8	0.171	0.194	0.190	0.186
9	0.161	0.172	0.173	0.172
10	0.121	0.161	0.161	0.160
11	0.117	0.122	0.121	0.121
12	0.113	0.117	0.1167	0.117

5.1 Time Period (in sec)

The time span of the design for a particular mode shape is the time required fundamental to finish the swaying for relating mode shape. Subsequent to giving unit removal to the construction and when liberating the dislodging out of nowhere the design will in general move in to and fro movement having some time-frame which is named as essential time span of the construction. Time span established for working with floating column and working without floating column for different models are given in the Table 1, additionally variety in time-frame is appeared in fig. 6 graphically.

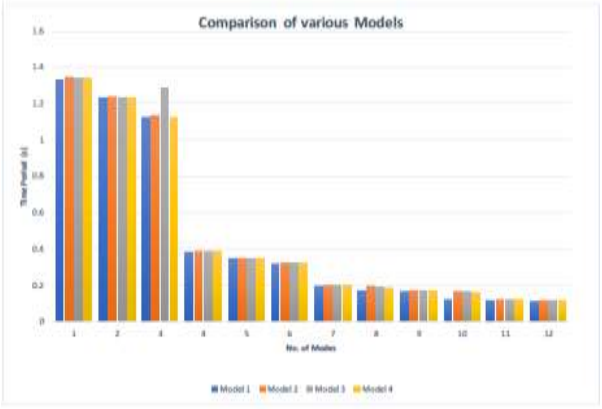

Figure 7: Comparison of time span for no. of models and for different models

5.2 Response Spectrum Analysis

Table 2: Base Reaction (in KN) for different models

Model Description	Base Reaction (in KN)
Building without FC (Model-1)	1308.901
Building with FC at 1st Floor (Model-2)	1300.962
Building with FC at 2nd Floor (Model-3)	1303.483
Building with FC at 3rd Floor (Model-4)	1305.468

5.2.1 Base Reaction (in KN)

Base shear characterized as level response at the base rather than flat shake load. This base shear acts at base or at the help level of the construction or at the fixed end of structures. The distinction in base shear because of the diverse situation of floating or hanging segment floor wise are classified in Table 2, additionally variety in base shear are shown through chart in fig.7

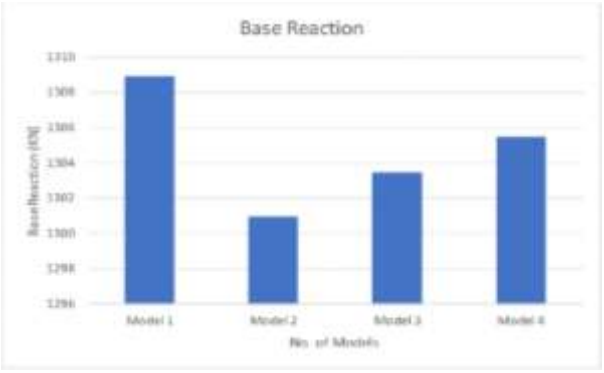

Figure8: Comparison of Base Reaction for different models

5.3 Storey Displacement

It is displacement of storey with respect to the bace of structure.

Displacement is the distance form witch one element (beam, column etc) moved from its origanal location deflection is the distance that an object bends twists from its original position.

Table 3: Displacement of Different Models along X-Direction (in mm)

S. No.	Height of Structure	Displacement in Direction-X (mm)			
		Model-1	Model-2	Model-3	Model-4
1.	0	0	0	0	0
2.	3.1	7.000	7.700	7.500	7.510
3.	6.2	12.000	12.500	12.100	12.110
4.	9.3	15.300	15.700	15.500	15.310
5.	12.4	17.000	17.900	17.700	17.600
6.	15.5	18.001	19.200	19.100	18.990

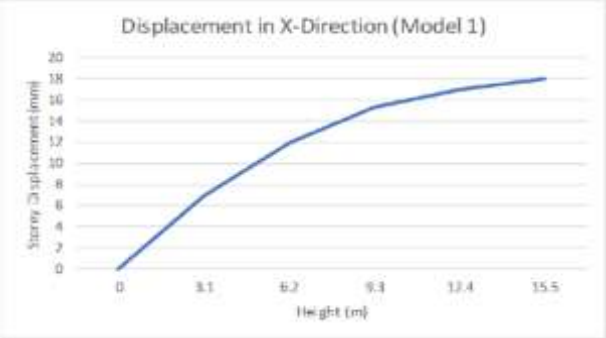

Figure 9: Model 1 - Displacement in X-direction

This fig is indicate the structure is twist or bends in X-direction

Figure10: Model 2 - Displacement in Direction-X

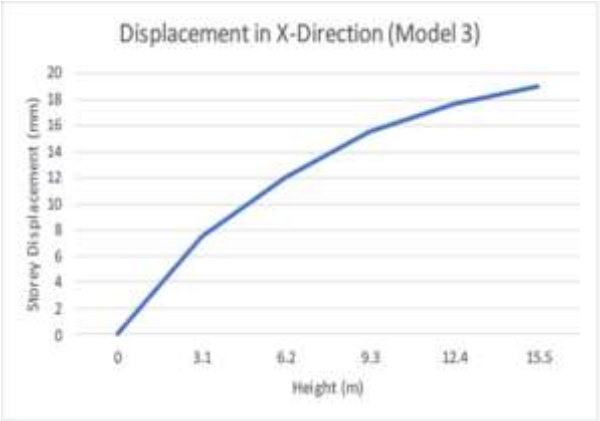

Figure 11: - Model 3 - Displacement in Direction-X

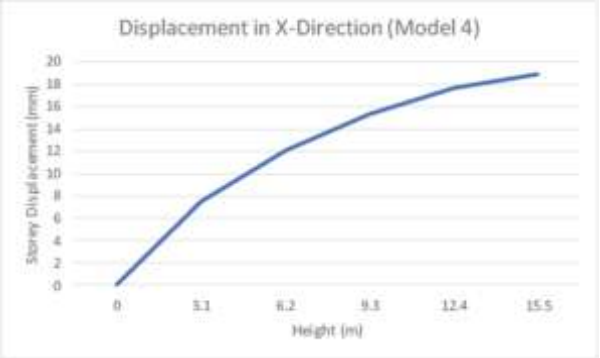

Figure 12: - Model 4 - Displacement in X-Direction

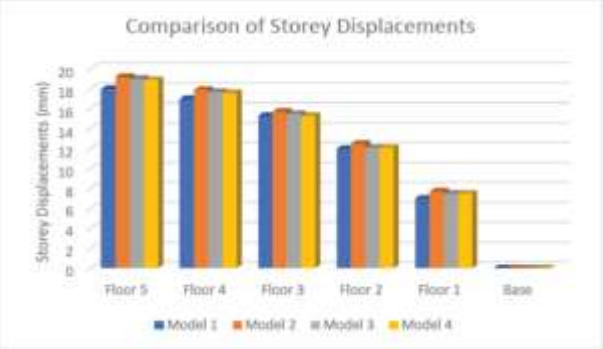

Figure 13: Comparison of Storey Displacement of Different models

5.4 Joint Detailing

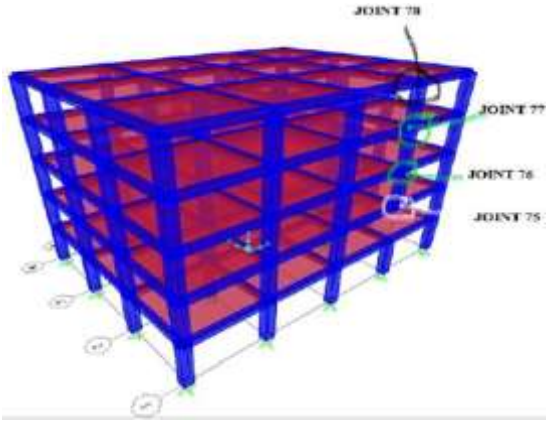

Figure 14: - Joint detailing of 3D Model

For Joint 75

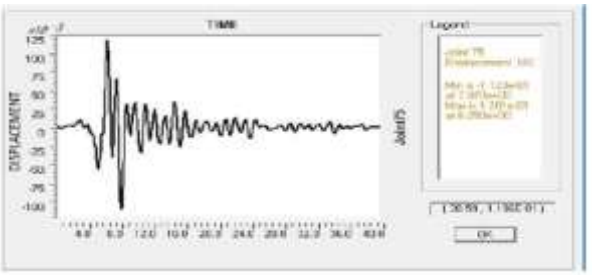

Figure 15: Displacement v/s Time, for Model-2

From the above figure we can see that the peak displacement of the joint 75 is 121 mm.

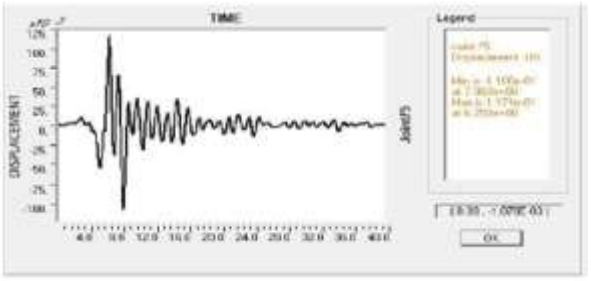

Figure 16: Displacement v/s Time for Model-3 (FC at 2nd Floor), Joint 75.

From the figure 16 this is directly seen that at the time of earthquake, the supreme displacement of joint 75 along x-direction is 0.116 m.

Joint 76

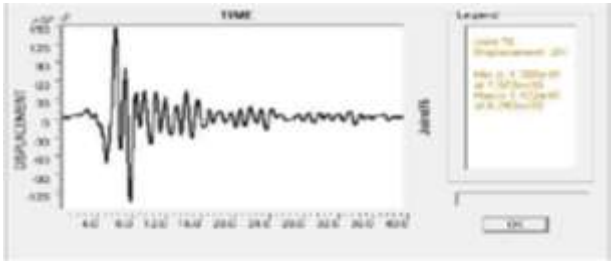

Figure 17: - Displacement v/s Time (for Model-3 (FC at 2nd Floor)

From figure 17, it is cleared that the peak displacement of joint 76 is 0.1471 m.

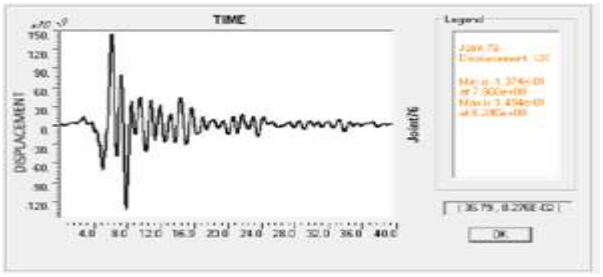

Figure 18: - Displacement v/s Time for Model-4 (FC at 3rdFloor)

It is concluded from the above plot that the maximum displacement of the joint is 0.1453m.

Joint 78

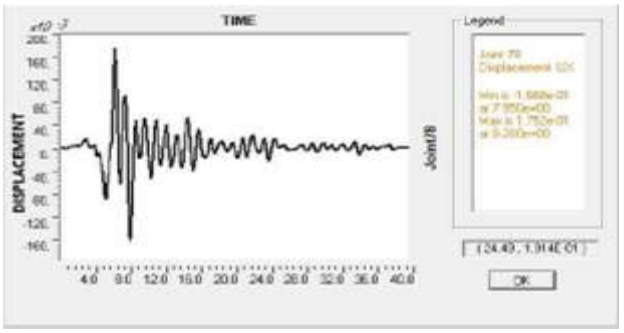

Figure 19: - Displacement v/s Time, for Model-4 (FC at 3rd Floor)

It is concluded from the above plot that the maximum displacement of the joint is 0.1753m

6. CONCLUSION

Following conclusions are drawn from the recent study:

- Time span of the structure without floating column is less and is most extreme when floating column is close to the basement. It tends to decrease when hanging segment is available in the upward floors.
- Displacements of different floors longitudinal way for example x-direction is decided and it has been seen that when coasting section is given story displacement is slightly higher than the ordinarily built structure without thinking about any discontinuity.
- From the reaction range examination, base response of the structure rises when we move floating column to the upper floors being most reduced for the principal1st floor and greatest when there is no such floating column.
- Drift of a specific story increments because of the presence of floating column in the structure.
- It has been seen that chances of failure of buildings of structures with floating column are a lot higher when contrasted with the structures

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Corresponding Author

Vishwanth T. Kambale*

Department of Civil Engineering, SVERI'S Collage of Engineering, Pandharpur, India