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Seismic Performance of Floating Column in Multistory Building

Prashik Dongare, Prof. Sushant M. Gajbhiye

P.G. Student, Department of Civil Engineering, Guru Nanak Institute of Engineering and Technology, Nagpur,
Maharashtra, India

Associate Professor, Department of Civil Engineering, Guru Nanak Institute of Engineering and Technology, Nagpur,
Maharashtra, India

ABSTRACT: Column is the main component of the building. It is a supporting member of the structure. The function of the column of the structure is to provide the support to the structure and transfer the load to the ground via column member. The beam, slab etc. are resting on the column. Some of the new concept is in mind i.e. stub column. In this the structure is resting on the main column and the intermediate column is started from the above story of the structure so that the stability is also provide to the structure and the structure is becomes the economical.

In this project, the two type of structure is formed in the ETABS-18 software in which one is conventional structure and the other one is stub column structure. The plan of the structure is made in AUTOCAD software and the drawing is imported in the ETABS-18 software. The some kind of loading is applied on the structure. The comparative result should be checked and shown in the form of graphs.

KEYWORDS: Stub column structure, ETABS-18, Conventional Structure.

I. INTRODUCTION

Numerous metropolitan multi-storey structures in India today have open first story as an unavoidable component. This is essentially being taken on to oblige stopping or gathering anterooms in the primary story. Though the complete seismic base shear as experienced by a structure during a earthquake is reliant upon its regular period, the seismic power appropriation is subject to the circulation of solidness and mass along the stature.

The conduct of a structure during earthquakes relies basically upon its general shape, size and calculation, notwithstanding the way in which the quake powers are conveyed to the ground. The quake powers created at various floor levels in a structure should be brought down along the tallness to the ground by the briefest way; any deviation or intermittence in this load move way brings about lacklustre showing of the structure. Structures with vertical misfortunes (like the inn structures with a couple of story more extensive than the rest) cause an abrupt leap in earthquake powers at the degree of intermittence. Structures that have less sections or dividers in a specific story or with curiously tall story will quite often harm or breakdown which is started in that story. Numerous structures with an open ground story expected for stopping imploded or were seriously harmed in Gujarat during the 2001 Bhuj earthquake. Structures with sections that hang or float on radiates at a middle story and don't go the whole way to the establishment, have discontinuities in the load move way.

What is stub column?

A section should be an upward part beginning from establishment level and moving the load to the ground. The term drifting segment is additionally an upward component which (because of structural plan/site circumstance) at its lower level (end Level) lays on a bar which is a flat part. The shafts thusly move the load to different sections underneath it.

There are many undertakings in which drifting sections are embraced, particularly over the ground floor, where move supports are utilized, so that more open space is accessible in the ground floor. These open spaces might be needed for gathering lobby or stopping reason. The exchange braces must be planned and detailed appropriately, particularly in earth shake zones. The section is a focused burden on the pillar which upholds it. All things considered, the segment is regularly accepted stuck at the base and is in this way taken as a point load on the exchange bar. STAAD Pro, ETABS and SAP2000 can be utilized to do the investigation of this kind of design. Drifting sections are sufficiently able to

convey gravity stacking yet move support should be of satisfactory aspects (Stiffness) with exceptionally insignificant avoidance.

II. METHODOLOGY

Static analysis

Plane frame element

The plane casing component is a two-layered limited component with both nearby and worldwide directions. The plane edge component has modulus of flexibility E , snapshot of dormancy I , cross-sectional region A , and length L . Each plane edge component has two hubs and is leaned with a point of θ estimated counter clockwise from the positive worldwide X pivot as displayed in figure. Let $C = \cos\theta$ and $S = \sin\theta$.

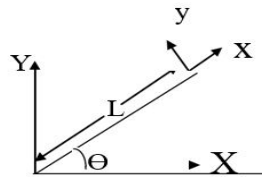


Figure 2.1 The plane frame element

Obviously the plane edge component has six level of opportunity - three at every hub (two relocations and a pivot). The sign show utilized is that removals are positive assuming they point upwards and pivots are positive assuming that they are counter clockwise. Thusly for a design with n hubs, the worldwide solidness framework K will be $3n \times 3n$ (since we have three levels of opportunity at every hub). The worldwide firmness grid K is gathered by settling on decisions to the MATLAB work Plane Frame Assemble which is composed extraordinarily for this reason.

Procedure adopted for design

1. Make the plan of the building with the help of the AutoCAD software which is shown below.

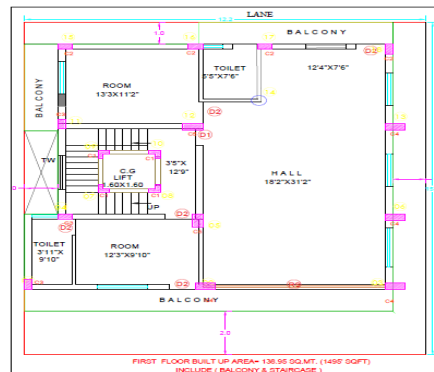


Figure 2.2 Plan of the structure

2. Place the UCS icon at the corner of the building and taken out the co-ordinate of the structure which is shown in tabular form.

Table No. 2.1 Co-ordinate of the building

X	Y	Z
0	0	0
5.23	0	0
10.96	0	0
10.96	3.195	0
10.96	7.325	0
10.96	11	0

7	11	0
5.23	11	0
1	11	0
1	7.36	0
1	3.23	0
0	3.23	0

3. Open ETABS-18 and take the new model having set the parameter such as IS code for steel, IS code for Concrete etc. choose IS code for concrete is IS 456-2000 and for steel it is IS 800-2007. Then specify the story height, grid system by place the co-ordinate of the building.

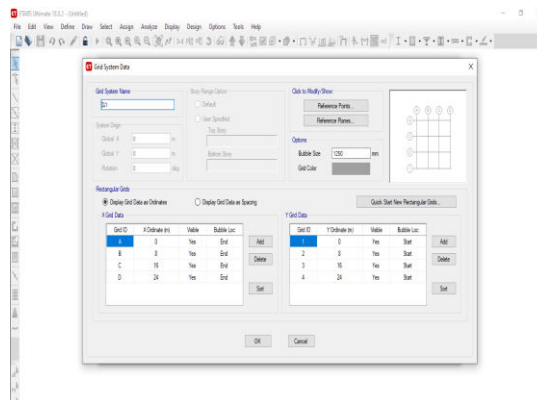


Figure 2.3 Grid systems in the software

4. Specify the column size as 300 x 600 mm and the beam size as 350 x 600 mm. the slab thickness of the building is 200 mm. there are two models are formed i.e. conventional model and stub column model with the same procedure adopted above.

III. RESULT AND DISCUSSION

- Story Displacement

The displacement of the story due to application of loading condition is to be analysed by the Etabs-18 software. There are two type of structure is used in which one is conventional structure whose column is in position and the other one is stub column structure in which only outer column is placed on the base story and the inner column is continue from the 1st story which is used as to provide partition wall. The movement of the structure in x, y, and z direction are to be shown in the structure.

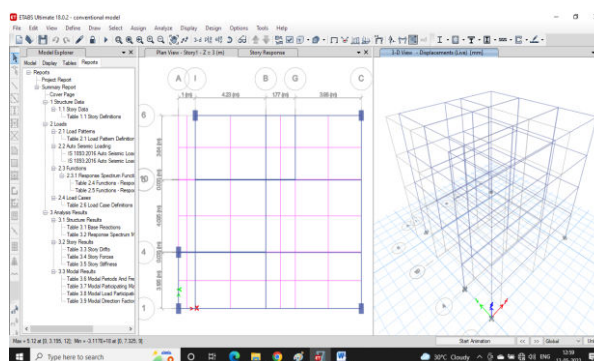
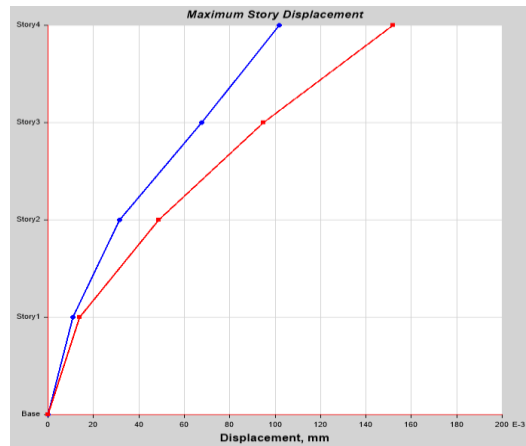


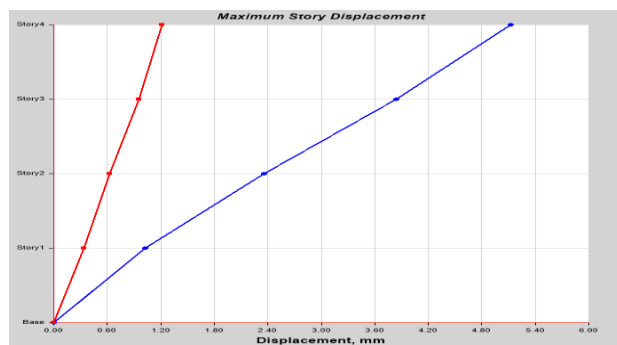
Figure No. 3.1 Displacement of the structure due to loading condition of conventional building



Graph No. 3.1 Maximum Story displacement of conventional building.

Table No. 3.1 Maximum story displacement in X and Y direction

Story	X-Dir	Y-Dir
	mm	mm
Story4	0.102	0.152
Story3	0.068	0.095
Story2	0.032	0.049
Story1	0.011	0.014
Base	0	0



Graph No. 3.2 Maximum Story displacement of stub column building.

Table No. 3.2 Maximum story displacement in X and Y direction

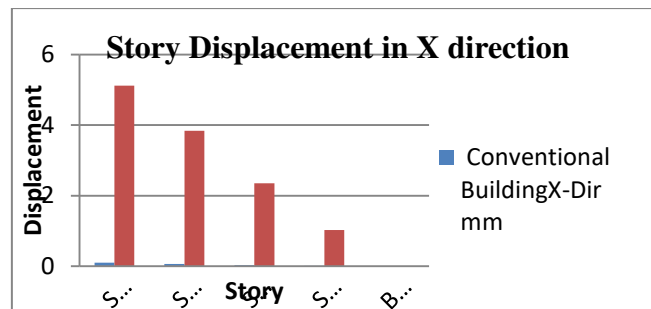
Story	X-Dir	Y-Dir
	mm	mm
Story4	5.12	1.219
Story3	3.838	0.955
Story2	2.354	0.63
Story1	1.022	0.338
Base	0	0

Comparison of the story displacement in X and Y direction

In this section it is clear that the comparison between the conventional and stub column building with maximum story displacement in X and Y direction are formed which is shown in tabular form.

Table No. 3.3 Comparison of Maximum story displacement in X direction

Story	Conventional Building X-Dir. mm	Stub Column Building X-Dir. mm
Story4	0.102	5.12
Story3	0.068	3.838
Story2	0.032	2.354
Story1	0.011	1.022
Base	0	0



Graph No 3.3 Comparison of story displacement in X direction

In this graph it is shown that the displacement in x direction of stub column has a greater intensity as compare to the conventional building. The stub column building is rest on the only five columns and rest of the columns are starting from 1st story so that all the loads are absorbed by the base column and due to which the maximum displacement occur in the structure. On the other hand, in conventional building the whole load is supplied to the base column so that the story is not displaced from their side.

IV. CONCLUSION

1. The story displacement in X-direction is more in stub column structure but at that of Y- direction the story displacement is more in conventional building.
2. The same case of story drift in which in X-direction the drifting is increased in stub column building and that of in Y-direction the drifting is increased in conventional building.
3. The spectral displacement in conventional building follows a particular pattern in the graph. For the 0 damping it is continued for some period and then it gradually increases. That type of case is happen in other damping condition but for 0 damping the spectral displacement is increased.
4. The spectral displacement in stub column building, at 2.7 second, the maximum spectral displacement is found out.
5. Spectral acceleration of conventional building for 0 damping ratio has a maximum value of 200 mm/sec². It is seen that less damping ratio has a maximum spectral acceleration and for higher damping ratio has less spectral acceleration of the structure. Spectral acceleration is the movement of the structure due to the seismic effect on the structure.
6. For a less time period has a maximum spectral acceleration but less as compare to the conventional building. Here it is seen that the spectral acceleration from 0 sec to 0.8 sec. it goes maximum but from 0.8 sec. it is gradually decrease and at less time period it is stopped.

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