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Comparative Study of Seismic Behaviour on Floating and Non-Floating Column Structure (G+7)

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ABSTRACT

In present scenario buildings with floating column is typical feature in modern multi-storey construction in India. Such features are unavoidable in building built in seismically active areas. The present study investigates the effects of the structural irregularities which are produced by discontinuity of column in a building subjected to seismic load. The structural response of building of 8 storey model with respect to fundamental time period, spectral acceleration, Base shear. Storey drift and storey displacement is investigated. Results shows that provision of floating columns increases story displacements. Same is with story drift, provision of floating columns increases story drift. FC is not preferable in higher earthquake zones because of high value of displacements according to code.

Keywords : Floating Column, RCC frame, Column Shear, STAAD-PRO, Base Shear, Fundamental Time period

I. INTRODUCTION

I.I General:-

Buildings with floating column are generally being important in modern multi-storey construction in urban India. This type of construction is highly undesirable in building built in high seismic zone. The buildings in this zone are being hazardous during earthquake. The load from above constructed structure which is sustained by the column is transferred as point load on the beam. The beam deflects due high bending moment at that point and for that reason much amount of steel is require to resist that deflection. Much amount of steel decreases the spacing between two bars.

Due to less spacing between two bars does not allowed concrete to pass from them. Therefore it may create brittle failure in building during earthquake. Much amount of reinforcement does not satisfy the ductile detailing code IS13920.

As report from Government of Gujarat, during 2001Earthquake in Bhuj the building with floating column as its structural component is damaged during earthquake. And also stated that the buildings with floating column as its structural component are not more usable for purpose of residence or commercial etc. for people. These structures are showed much amount of deflection and brittle failures in its structural components.

I.II. Floating Column:-

In Structural engineering, a column is supposed to be a vertical member starting from foundation level and transfer the load to the ground through foundation is called as regular columns.

The term floating column is also a vertical element which ends at its rests on a beam which is a horizontal member and transfer the load of the structure through column to beam.

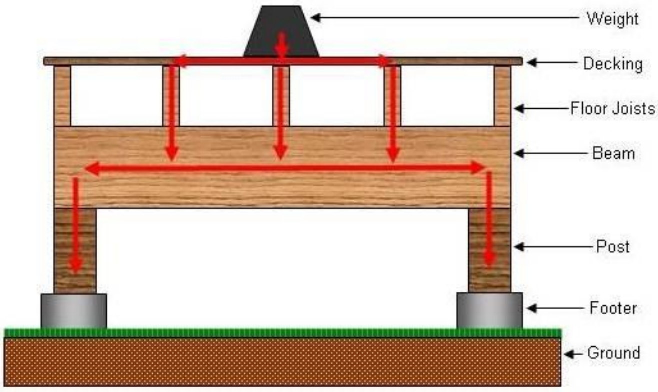

Fig. I.II. Floating column

II. METHODS AND MATERIAL

To determine seismic behaviour of the Buildings with and without floating columns for zone V the basic components like inter storey drift, lateral displacement analysis has been carried using the software STAAD pro. For the analysis purpose Equivalent static method, and Response spectrum methods are adopted.

Two buildings with floating columns and without floating columns were analysed for seismic loading. The buildings chosen were 24m high buildings. To study the effect of seismic loading the buildings were modified in two different ways so that total numbers of cases are namely:

Model 1 FC: Where 6 floating columns are provided. Height of per story is 3m.

Model 1 WFC: This model is same as Model 1 FC but floating columns are converted into non-floating columns.

Loading Considered:

Live Load = 3 KN / m^2

Floor Finish =1 KN / m^2

Exterior Wall Load = 12 KN / m^2

Interior Wall Load = 6 KN / m^2

For analysis of structure, 13 load combinations were considered

1. 1.5(DL+LL)
2. 1.2(DL+LL+EQX)
3. 1.2(DL+LL-EQX)
4. 1.2(DL+LL+EQY)
5. 1.2(DL+LL-EQY)
6. 1.5(DL+EQX)
7. 1.5(DL-EQX)
8. 1.5(DL+EQY)
9. 1.5(DL-EQY)
10. 0.9DL+1.5EQX
11. 0.9DL-1.5EQX
12. 0.9DL+1.5EQY
13. 0.9DL-1.5EQY

However it was found that combination 6 i.e. 1.5(DL+EQX) was critical. Zone IV was considered for earthquake and response reduction factor of 5 was taken.

III. RESULTS AND DISCUSSION

Analysis was carried out by using Extended Three Dimensional Analysis of Building Systems STAAD Pro software and following results were obtained:

Displacement:-

Table I

STOREY	MODEL 1 FC	MODEL 2 WFC
0	0	0
1	3.9	0.7
2	17.7	4.1
3	33.7	7.8
4	48.2	11.4
5	61	14.5
6	72.6	16.7
7	87.1	19.1

Storey Drift:-

STOREY	Model 1 FC	Model 2 WFC
0	0	0
1	1.8	1
2	4.5	3.4
3	5.3	4.1
4	4.8	3.5
5	4.2	3.1
6	4	2
7	3.8	1.9

Table 1 give the values of story drifts and Table.2 give values of displacements for model 1 FC and model 1 WFC.

When earthquake load is applied there is large difference between values of story drifts. When floating columns are provided story drift increases by a considerable amount. Values of drift are much less when floating columns are not provided. This difference can be seen in both the models.

The comparison between the values of story displacements for structures with floating columns and same structure with non-floating columns. When seismic loads are applied, the values of story displacements increases enormously in the structures provided with floating columns and in the structures provided with non-floating columns, the values are well within limits.

Now days floating columns are being used in India on large scale. To make maximum use of space floating columns are provided. But the result clearly shows that, structures with floating columns behave poorly during earthquake. Thus, the use of floating columns should be avoided in higher seismic zones. In general also floating columns should be provided only if the necessity is high.

IV. CONCLUSION

In the present investigation, an attempt has been made to compare the seismic behaviour of multi-storied structures with floating columns and without floating columns, and the following are the conclusions drawn:

1. Provision of floating columns increases story displacements.

Same is with story drift, provision of floating columns increases story drift.

2. Model 1 FC not preferable in higher earthquake zones because of high value of displacements according to code.

3. Combination 6 i.e. 1.5(DL+EQX) was found to be critical load combination.

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