EVALUATION OF SEISMIC REACTION UNDER ZONE 4 & 5 FOR G+20 BUILDING WITH & WITHOUT FLOATING COLUMN

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Abstract : The construction of building with floating column may be difficult in seismic zones but it may not be impossible, it is the need or demand to comprehend the earthquake impact forces that grows at various levels of floors which is then carried down along the height of the building by the smallest path. During earthquake or seismic forces the entire conduct of the building depends analytically on the size of building, its shape and its geometry along with the earthquake forces that are initiated from the ground storey that may lead to parking failure and tends to cause heavy damage. Where as in this project totally 4 models have been analyzed for the seismic zone 4 and zone 5 respectively as per IS 1893:2002 by using ETABS v9.5.0. Version by equivalent static method, 2models is analyzed without floating column with respect to zone 4 and zone 5. Whereas other 6 models are analyzed with floating columns at different levels of buildings with respect to zone 4 and zone 5. The outcome results are differentiated concerning with roof displacement, storey-drift, and base. Shear storey forces and time. period as per the zones contrast is made and graphs are planned

Index Terms **- Floating Column, Equivalent static method, displacement, storey drift, Time period.**

I. INTRODUCTION

In times of earthquake the building go through the seismic base shear which depends upon the seismic natural period. The distribution of seismic forces mainly depends upon the stiffness distribution and mass through its height The entire shape, size and geometry are the main features which mainly depend on building behavior during the earthquake. When earthquake occurs the seismic forces are transfer from building to the ground from its smallest way the disruption in transferring of loads leads to the weak building presentation. In high rise buildings with less column requirement and walls during earthquake these buildings tends to cause severe damage.

1.1 Floating Column

The columns is the upright element which begins from the foundation and declines at the top the load transformation takes place from the top to bottom then to foundation, where as the floating column is the upright element that repose on the beam there by the beam transfers the load to the other columns on which the beam is resting. In most of the project the floating columns are adopted at the ground floor where girders are also used for the lot of space requirement. The requirement may be due to parking facilities or for the big open hall and may also for other reasons. The used gurder should be properly designed and detailed specially in the seismic zones areas.

Different software may be used for the analysis of these structures such as like STAAD PRO, SAAP, ETABS, etc… for the floating column analysis the column bas should be pinned there by it holds as point load at the transfer beam. The transfer girders should be of accurate size and should have less deflection.

1.2 Transfer Beam

In the structure where the column doesn't transfer load to the foundation mainly due to some limitations and this issue can be sort out by transfer beam. It's a beam which carries heavy load i.e. column load. These beams takes load from the column and transfer it to other columns on which it's lying.

1.3 Objective Of The Study

The motive of this dissertation work is to differentiate the action of G+20 multistory commercial building under the seismic zone 4 and zone 5 for the medium soil. The building models are generated with and without floating columns.

- To differentiate the dissimilarities between the building with and without floating columns under the earthquake forces.
- To differentiate the seismic action of RC building under the zone 4 and zone 5 with and without floating columns.

- To differentiate the roof displacement, storey-drift, storey-forces, base shear and time-period for zone 4 and zone 5.
- To show the difference in base shear calculation manually with the analysis done through ETABS for model 1 under zone 4.

II. LITERATURE REIVEW

SUKUMAR BAHERA (2012): In order to minimize the irregularity that is caused due to the floating column has been studied in this paper under the different earthquake having different frequency level, where the time duration factor and PGA scale are kept constant under the free vibrations, forced vibration condition and static load the action of the building with and without floating column has been carried out. The conclusion says that along the change with the column size there is variation in the base shear and the overturning moment.

SHRIKANT.M.K, YOGENDRA.R. (2014): They compared the building action with and without floating column complexion in high rise building under the earthquake forces for the medium soil. Displacement and storey drift for the models are computed as results.

T.RAJA , MR. PRASAD.(2014): The action of building behavior with the variation of floating column has been studied. The results are analyzed in terms of comparison with time history, base shear. The methodology used is equivalent static method which will find the analytic property of the building structure in order.

A.P.MUNDADA, S.G.SAWADAKAR. (2014): In this paper the comparison of already existing residential building is carried out, equivalent static analysis of the model is done the parameters like moment distribution, axial load line of action importance and the seismic parameters are carried out for this study.

HARDIK BENSDADI, SIDHART SHAH. (2015): The study reveals the outturn of various floating columns in various seismic zones; pushover analysis is done as it shows the building performance level. The determination of collapse load and structure ductility capacity is done. The RC frame of G+4, G+9, G+15 respectively is compared with the base force in different zones.

III. METHODOLOGY

EQUIVALENT STATIC ANALYSIS (IS 1893:2002)

It is the untangled proficiency to replace the reaction of dynamic loading of anticipated seismic frequency by static force which is dispensed laterally on structure for outline need. The entire earthquake force V is normally valuated in two parallel directions which is level to the chief axis of the building structure. The structure should be strong enough, to bare the effects that are caused by the earthquake in any one way not in two ways.

Inertia forces are the results caused due to the earthquake. Therefore the building structure should be strong to securely transfer the horizontal and vertical inertia forces that are grown in superstructure from it to the ground passing through foundation. Therefore the seismic zone building design needs appropriate lateral load resisting ability. The code will help the designer to choose the correct methodology for the analysis as well as for the design purpose.

DOMAIN OF APPLICATION

This method can appeal the building where reaction isn't mainly over elaborated by involvement from the modes of vibration higher than the fundamental mode in one direction and involving the benchmark for building height, horizontal and vertical consistency. This method of analysis is limited with respect to earthquake zones. This method is suggested to be limited to the structures which have regular configuration with continuous earthquake forces, with standing elements & a relative unvarying dispensed stiffness and mass

IV. ANALYTICAL MODELING

In this dissertation work all models of commercial building are generated as per IS codes for the seismic zone 4 and zone 5 and by equivalent static method ETABS v9.5.0 is used for analysis.

Description of the Model's:

The model comprises of G+ 20 stories building which has 4models for seismic zone 4 and zone 5

1) **Model 1:** The model comprises of G+20 storey building except any floating column which is normal building under zone-4 and zone-5.
2) **Model 2:** The model comprises of G+ 20 storey building with floating column at storey1 (ground floor) under zone-4 and zone-5.
3) **Model 3**: The model comprises of G+ 20 storey building with floating column at storey3 (1st floor) under zone-4 and zone-5.

4) **Model 4**: The model comprises of G+ 20 storey building with floating column at storey10 (9th floor) under zone-4 and zone-5.

Table 4.1 : DATA FOR MODEL-1

Type of structure	RC framed structure
Type of model	Non floating column
Plan	40m x40m
Number of bays	5
Size of each bay	8m
Number of storeys	G+20
Storey Height	3.2m
Conc. Grade	M25
Steel Grade	Fe-500
beam Size	230x450
Size of column	230x600
Slab thickness	150mm
Wall thickness	230mm
Load calculation	
Self weight of wall on each floor	13.24 KN/m
Live load(L.L)	4 kN/m
Floor finish(F.F)	1 kN/m
Earthquake analysis using IS:1893:2002 for zone-4	
Seismic zone	4(iv)
Zone factor[Z]	0.24
Importance factor[I]	1
Response reduction factor[R]	5
Geological soil type	Medium
Earthquake analysis using IS:1893:2002 for zone-5	
Seismic zone	5(V)
Zone factor[Z]	0.36
Importance factor[I]	1
Response reduction factor[R]	5
Soil type	Medium

Table 4.2 DATA FOR MODEL-2,3,4

Type of structure	RC framed structure
Type of model	floating column
Plan	40m x40m
Number of bays	5
Size of each bay	8m
Number of storeys	G+20
Storey Height	3.2m
Conc. Grade	M25
Steel Grade	Fe-500
beam Size	230x450
Size of column	230x600
Slab thickness	150mm
Wall thickness	230mm
Load calculation	
Self weight of wall on each floor	13.24 KN/m
Live load(L.L)	4 kN/m
Floor finish(F.F)	1 kN/m
Earthquake analysis using IS:1893:2002 for zone-4	
Seismic zone	4(iv)
Zone factor[Z]	0.24
Importance factor[I]	1
Response reduction factor[R]	5
Geological soil type	Medium
Earthquake analysis using IS:1893:2002 for zone-5	
Seismic zone	5(V)
Zone factor[Z]	0.36
Importance factor[I]	1
Response reduction factor[R]	5
Soil type	Medium

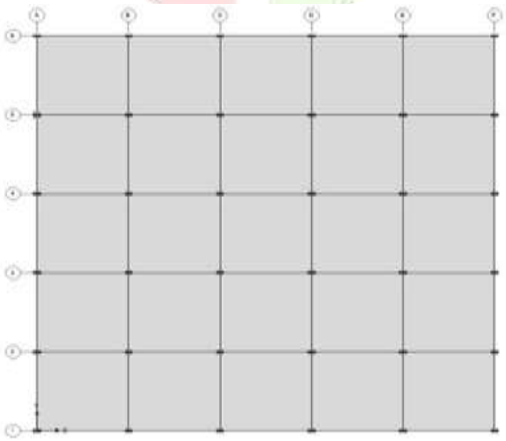


Fig. 4.1 : Plan of normal building Model-1

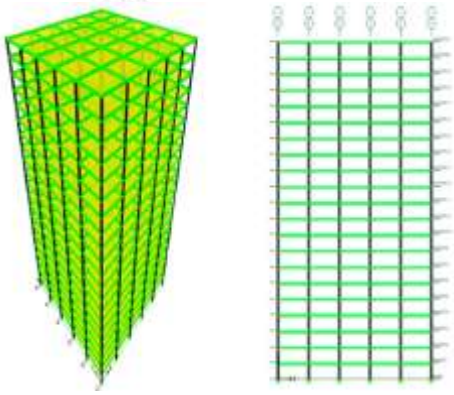


Fig. 4.2 : 3D view and elevation of model-1

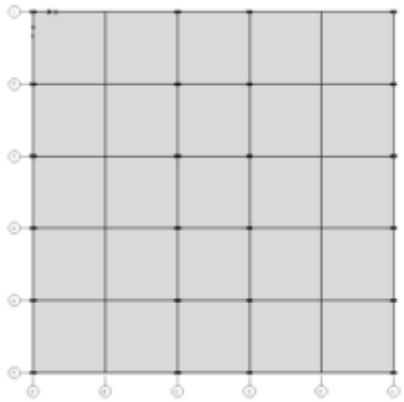


Fig. 4.3 : Plan_of GF with floating Column Model-2

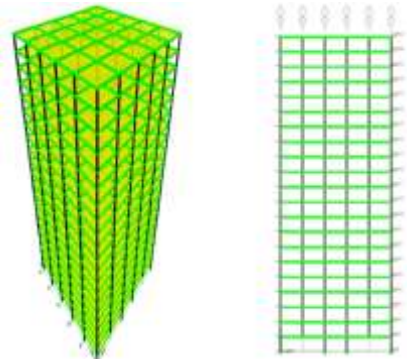


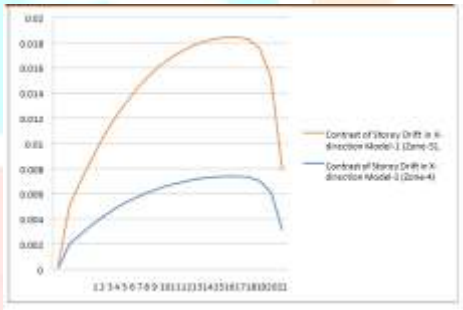
Fig. 4.4 : 3D view and elevation of model-2

V. RESULTS AND DISCUSSION

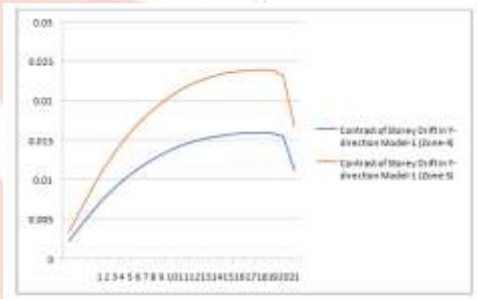
All these 4 models under zone 4 and zone 5 are analyzed using ETABS v9.5.0. Seismic outturn of the structure is examined and the models are compared in both the zones. IS 1893:2002 is used to carry out the seismic analysis. Equivalent static methodology is used. The results are contrast for storey drift, storey displacement, base shear, storey forces and time period.

5.1 Storey Drift

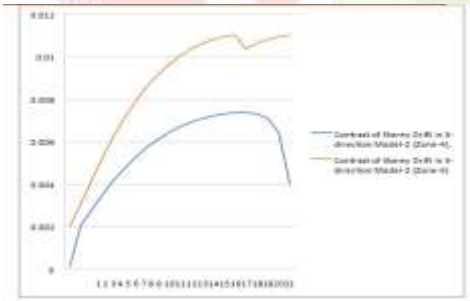
It explicate proportion of displacement as a part of 2 consecutive floor to height of that floor.



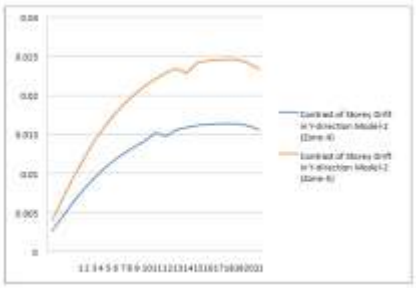
Graph 5.1.1 storey drift for model-1 in X-direction



Graph 5.1.2 storey drift for model-1in Y-direction



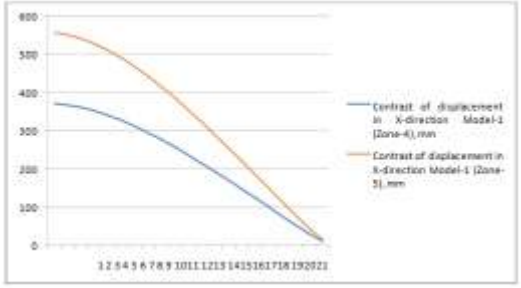
Graph 5.1.3 storey drift for model-2 in X-direction

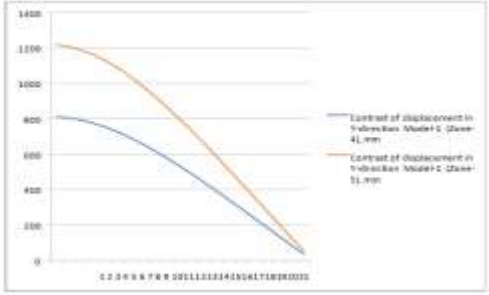


Graph 5.1.4 storey drift for model-2 in Y-direction

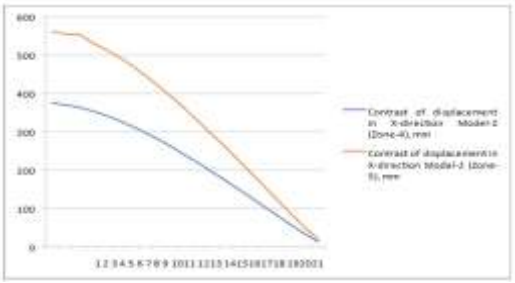
5.2 Storey Displacement

It is total displacement of its storey concerning ground or it is the lateral displacement of storey relative to the base.

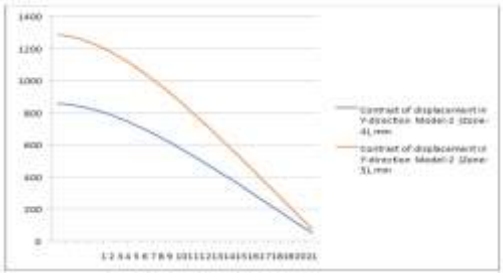




Graph 5.2.1 displacement for model-1 in X-direction



Graph 5.2.2 displacement for model-1 in Y-direction

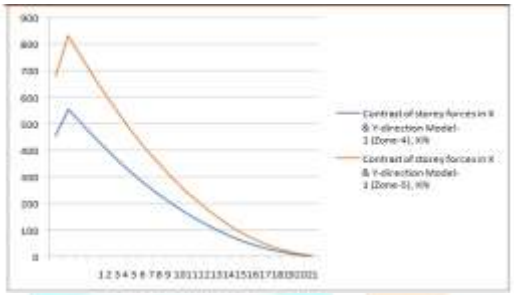


Graph 5.2.3 displacement for model-2 in X-direction

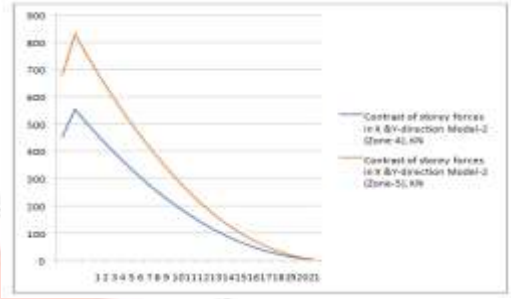
Graph 5.2.4 displacement for model-2 in y-direction

5.3 Storey Forces

The forces acting on a building in a lateral direction.



Graph 5.3.1 storey forces for model-1 in X & Y-direction



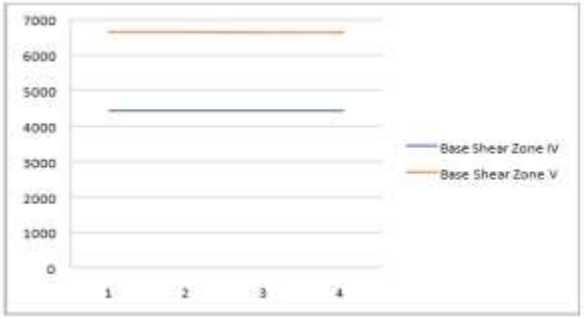
Graph 5.3.2 storey forces for model-2 in X & Y-direction

5.4 Base Shear

An estimate of maximal anticipated sideway force which may come because of seismic ground movement at the plinth of building and it is designated as V which depend upon the soil condition Geological features the seismic frequency and the time period.

Table 5.4.1 : Base Shear

Model	Zone IV	Zone V
1	4427.49KN	6641.24KN
2	4426.82KN	6640.23KN
3	4425.75KN	6638.63KN
4	4425.75KN	6638.63KN



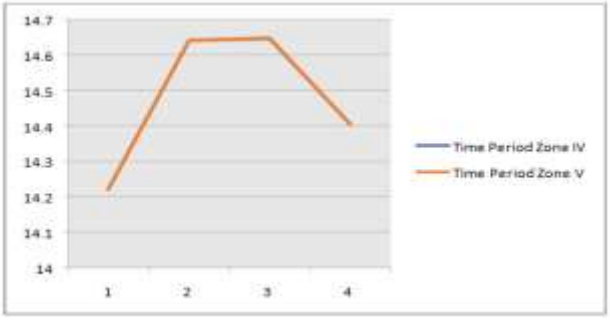
Graph 5.4.1 Contrast of base shear in IV & V Zone

5.6 Time Period

The time required to complete an entire revolution of vibration in order to go through a stated/specific point a given point. As the frequency of wave escalates as the time period of wave diminish. They are inversely proportional

Table 5.6.1 : Time Period

Model	Zone IV	Zone V
1	14.2197 Sec	14.2197 Sec



2	14.6399 Sec	14.6399 Sec
3	14.6460 Sec	14.6466 Sec
4	14.4030 Sec	14.4030 Sec

Graph 5.6.1 Contrast of Time Period in IV & V Zone

VI. CONCLUSION

- Displacement in x-direction of model- 1 on ground to zone 4 and zone 5 is 370.419 and 555.629 for storey 21 where as in y-direction the displacement with respect to zone 4 and zone 5 is 811.291 and 1216.937. The value of displacement in y-direction is increased when compared to y-axis.The displacement in x-direction for model 2 with respect to zone 4 and zone 5 is 374.450 and 561.675 for storey 21 where as in y-direction the displacement with respect to zone 4 and zone 5 is 855.993 and 1283.990
- Storey drift is the variance in displacement of two consecutive floor to that of its floor height, the storey drift values depends upon the displacement of building on each floor. There is no variation in time period between all the models under zone 4 and zone 5.
- The base shear is greater in zone 5 when compare to zone 4. The values in x & y directions are same. The base shear is 1 KN lesser in floating column model than base shear of model 1. The storey forces are higher in zone 5 than zone 4 and are same in both directions.
- In base shear manual calculation the value id 5044.44 KN and by analysis its 4427.49 KN. The approximate difference is 600KN which is acceptable.
- Since there is no major difference in values of displacement. Story drift, time period and storey forces between the zone 4 and zone 5 with and without floating column. The building with floating columns can be easily adapted in both the zones without any limitations and the building with floating column tends to be safe and economical.

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