A REVIEW ON SEISMIC BEHAVIOUR OF FLOATING COLUMN AND TRANSFER BEAM

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Abstract - *Now a day's lots of multi-storey buildings are constructed with floating column for aesthetic point of view and for getting more space at parking areas for movement. In this study about analysis of G+7 Building without floating column, with floating column resting on normal reinforced transfer beam and with floating column resting on pre-stressed beam in seismic zone 3. Response spectrum analysis and time history analysis are carried out of all the three models. From the linear dynamic analysis comparing all the of models result obtained in the form of seismic parameter such as time period, base shear, storey displacement, storey drift .and from time history analysis plotting the response of all the models. Modelling and analysis done by using e-tabs and sap 2000v17 software.*

Key words: Floating column, Earthquake analysis, E-tabs, SAP 2000 v17.

1. INTRODUCTION

In recent times, multi-storey buildings in urban cities are required to have column free space due to shortage of space, population and also for aesthetic and functional requirements. For this buildings are provided with floating columns at one or more storey. These floating columns are highly disadvantageous in a building built in seismically active areas. The earthquake forces that are developed at different floor levels in a building need to be carried down along the height to the ground by the shortest path. Deviation or discontinuity in this load transfer path results in poor performance of the building. The behavior of a building during earthquakes depends critically on its overall shape, size and geometry, in addition to how the earthquake forces are carried to the ground. Many buildings with an open ground storey intended for parking collapsed or were severely damaged in Gujarat during the 2001 Bhuj earthquake. In tall building column is discontinued at ground and first floor level to facilitate larger opening at ground level to make access comfortable to the public area at the base. In 1950's and 1960's, some Eastern Europe scholars proposed the soft base level to achieve the large openings at the bottom level. A frame is constructed at bottom level to support the upper structure in this kind of structure. It is considered that this kind of structure has better performance during earthquake, but according to the current experiences, it has been proven that the concept is wrong. In 1978, many this kind of building collapsed during the Romania earthquake. A column is supposed to be a vertical member starting from foundation level and transferring the load to the ground. The term floating column is also a vertical element which ends at lower level (termination level) of the building. Due to architectural requirement and its rest on beam. The beams in turn transfer the load to other columns below it. In practice, the true columns below the termination level [usually the stilt level] are not constructed with care and more liable to failure. Nowadays larger opening at the ground floor level is achieved by use of transfer girder to collect the vertical and lateral load from the high-rise building component and then distribute them to the widely spaced column. However in the analysis of the transfer girder, consideration of the effect of interactive force in the overall analysis is beyond the range of the development of simple and approximate formula and requires proper modeling in order to have greater understanding the structural behavior and analysis. In past, transfer girder was designed as RC member. But since last many year the transfer girder is designed as PC member because of its advantages 2 over the RC member. For floating columns, the transfer girder and columns supporting transfer girder needs special attention. If load factor needs to be augmented for transfer girder and its columns to have additional safety of structure, shall be adopted. In the given system, floating columns need not be treated to carry any earthquake forces. Therefore earthquake forces are resisted by column/shear wall without considering contribution of floating column. This way the overall system as some breathing safety during earthquake. However, floating columns are competent enough to carry gravity loading but transfer girder must be of adequate dimensions with very minimum deflection. Though the floating column is unsafe especially under lateral loading, there are many projects in which they are adopted. Transfer girder must be design and detailed properly, especially in earthquake zones. If there are no lateral load, the design and detailing is not difficult. To understand proper behavior of transfer girder, its 3-D analysis must be done and must be very careful at the joint where the floating column meets the transfer girder.

2. LITERATURE REVIEW

Literature based on the modeling of multistory building with floating column and transfer beam under seismic behavior. From the detailed literature review, inference is studied.

1.Bahador Bagheri- in this paper a Multi-storey irregular buildings of 20 stories had been analyzed. This paper also deals with the effect of the variation of the building height on the structural response of the shear wall building The first floor is of 3m and the rest are of 3.2 m. Static and dynamic analysis is carried out with help of equivalent static, response spectrum & time history method and results are compared with each other. Equivalent analysis is carried out for low to medium rise buildings. Time history and response spectrum method is used for buildings with height 90 m for zone i and zone ii and 40 m for zone V. The results obtained by using these methods for zone v, the equivalent static analysis gives maximum displacement and maximum displacement of centre of mass in X & Y direction as compared to response spectrum and time history analysis.

2.Romy Mohan-in this paper, two multi storey buildings, one of six and other of eleven storey have been modeled using software package SAP 2000 12 for earthquake zone V in India. Six different types of shear walls with its variation in shape are considered for studying their effectiveness in resisting lateral forces. The paper also deals with the effect of the variation of the building height on the structural response of the shear wall. Dynamic responses under prominent earthquake, El-Centro have been investigated. This paper highlights the accuracy and exactness of Time History analysis in comparison with the most commonly Romy Mohan, [6],in this paper, two multi storey buildings, one of six and other of eleven storey have been modeled using software package SAP 2000 12 for earthquake zone V in India. Six different types of shear walls with its variation in shape are considered for studying their effectiveness in resisting lateral forces. The paper also deals with the effect of the variation of the building height on the structural response of the shear wall. Dynamic responses under prominent earthquake, El-Centro have been investigated.

3.Ms.Waykule.S.B1 et al-Now a day's lots of multi-storey buildings are constructed with floating column for aesthetic point of view and for getting more space at parking areas for movement. But such building are highly get damaged during earthquake in highly seismic zone as compared to normal building. In this paper present study about analysis of G+5 Building with and without floating column in highly seismic zone v. four models are created such as floating column at 1st, 2nd, and 3rd floor buildings and without floating column building. Linear static and time history analysis are carried out of all the four models .from linear static analysis compare all the of models result obtained in the form of seismic parameter such as time period, base shear, storey displacement, storey drift .and from time history analysis plot the response of all the models modeling and analysis done by using sap 2000v17 software.

4. Er. Sujal P Jasani et al - Transfer girder is used to transfer the load from the above story to the column which is support the transfer girder. Provide big space at the base level using floating column and transfer girder. And in architectural and aesthetic view of tall building it give important role. In now a day it is necessary to study the behavior of the girder because it is completely different to the beam. G+11 story building is modeled using E-tabs software and doing complete analysis by change of the position of the transfer girder in plan and also change in the position of the shear wall. Using E-tabs also done the construction stage analysis and comparison of the construction stage analysis and conventional analysis. Also doing the study of the flexural behavior of the beam which is exactly lies on the post tension transfer girder and the column which is supported the transfer gird.

5. **Shrikanth.M.K et al-** In this paper study is all about to compare the behavior of a building having only floating column and having floating column with complexities. High rise building is analyzed for earthquake force. For that purpose created four models and analyzed for lower and higher seismic zones for medium soil condition. Analysis was carried out by using extended 3 dimensional analysis of building system ETAB version 9.7.4 software. Results are presented in terms of Displacement, soft storey, storey drift for these four models and tabulated on basis of linear seismic analysis.

6. Susanta Banerjee* et al-This paper presents the effect of stiffness of infill wall to the damage occurred in floating column building when ground shakes. Modeling and analysis are carried out by non linear analysis programme IDARC- 2D. Damage occurred in beams, columns, storey are studied by formulating modified Park & Ang model to evaluate damage indices. Overall structural damage indices in buildings due to shaking of ground are also obtained. Dynamic response parameters i.e. lateral floor displacement, storey drift, time period, base shear of buildings are obtained and results are compared with the ordinary moment resisting frame buildings. Formation of cracks, yield, plastic hinge, are also observed during analysis. from this it is concluded that lateral floor displacement, storey drift of floating column building with infill wall are reduced than floating column building without infill wall. Also it is concluded that fundamental time period, lateral floor displacement of floating column building are higher than ordinary moment resisting frame.

7. **Hardik Bhensdadia* et al**-In this study an attempt is made to reveal the effects of floating column & soft story in different earthquake zones by seismic analysis. For this purpose Push over analysis is adopted because this analysis will yield performance level of building for design capacity (displacement) carried out up to failure, it helps determination of collapse load and ductility capacity of the structure. To achieve this objective, three RC bare frame

structures with G+4, G+9, G+15 stories respectively will be analysed and compared the base force and displacement of RC bare frame structure with G+4, G+9, G+15 stories in different earthquake zones like Rajkot, Jamnagar and Bhuj using SAP 2000 14 analysis package.

8. T.raja sekhar* et al-The behavior of building frame with and without floating column is studied under static load, free vibration and forced vibration condition. The results are plotted for both the frames with and without floating column by comparing each other time history of floor displacement, base shear. The equivalent static analysis is carried out on the entire project mathematical 3D model using the software STAAD Pro V8i and the comparison of these models are been presented. This will help us to find the various analytical properties of the structure and we may also have a very systematic and economical design for the structure.

9. A.p.mundada*, et al-In this paper study is done for architectural drawing and the framing drawing of the building having floating columns. For comparision G+7 existing residential building with and without floating column are taken for carry out entire project work. by using STAAD ProV8i 3D 3 model are created .equivalent static analysis of these model are done by using STAAD Pro V8i .Different parameters such as axial load ,moment distribution, importance of line of action of force and seismic factors are studied for models. This will help them to find the various analytical properties of the structure and also have a very systematic and economical design for the structure.

10. Sukumar Bahera*-In this paper involve stiffness balance of first storey and the storey above are studied to reduce irregularity occurs due to presence floating column. To study response of structures under different earthquake excitation having different frequency content keeping the PGA and time duration factor constant they develop FEM codes for 2D frames with and without floating column. The behavior of building frame with and without floating column is studied under static load, free vibration and forced vibration condition. The finite element code has been developed in MATLAB platform. The time history of floor displacement, inter storey drift, base shear, overturning moment are computed for both the frames with and without floating column. The dynamic analysis of frame is studied by varying the column dimension. It is concluded that with increase in ground floor column the maximum displacement, inter storey drift values are reducing. The base shear and overturning moment vary with the change in column dimension.

11. Prerna Nautiyal*, et al-In this paper investigate the effect of a floating column under earthquake excitation for various soil conditions and as there is no provision or magnification factor specified in I.S. Code, hence the determination of such factors for safe and economical design of a building having floating column. Linear Dynamic Analysis is done for 2D multi storey frame with and without floating column. For that purpose created the model G+4 and G+6 building having changing the position of floating column. After that response spectrum analysis is done for both building. Dynamic response parameters such as base shear and moment for hard and medium soil condition are obtained for both building models.

12.Er. Ashfi Rahman*-In this paper static analysis and dynamic analysis using response spectrum method is done for a multistoreyed building with and without floating columns. Different cases of the building are studied by varying the location of floating columns floor wise and within the floor. The structural response of the building models with respect to Fundamental time period, Spectral acceleration, Base shear, Storey drift and Storey displacements is investigated. The analysis is carried out using software STAAD Pro V8i software.

13. Sreekanth Gandla Nanabala1*,-Pradeep kumar. In this paper find whether structure is safe or unsafe with floating column when built in seismically active areas and also find floating column building is economical or uneconomical. For that purpose analysis of G+5 storey normal building and floating column building are done for external lateral forces. This analysis done by using sap2000.external lateral load are calculated manually. using equivalent static method for analysiscreated2D3model,model1,model2,model3.m odel1 is a normal building with same dimension f beam and column.model2 is floating column building without changing dimensions.model3 is floating column building with changing dimension of beam and column. And compare the both building based on displacement due to lateral load in terms of model1, model2.model3.also based on stiffness, and based on time history analysis. To check economy of both building compares steel and concrete quantity in terms of model, model2, model3.

3. CONCLUSIONS

1. It was observed that in building with floating column has more time period as compared to building without floating columns.
2. It was observed that in building with floating column has less base shear as compared to building without floating column
3. It was observed that displacement floating column building is more as compared to without floating column building.
4. It was observed that building with floating column has more storey drift as compared to building without floating column.
5. From dynamic analysis it was observed that floating column at different location results into variation in dynamic response.

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