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E-Mail
editor.ijmece@gmail.com
editor@ijmece.com

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ANALYSIS AND DESIGN OF MULTYSTORYED RESIDENTIAL BUILDING OF G+15 USING ETABS

* BYREDDY KAVITHA, **G SURESH

ABSTRACT:
Many of the buildings in India are constructed with floating columns. This is primarily beam adopted to accommodate parking or reception lobbies in the first story. Providing floating columns may satisfy some of the functional requirements but structural behaviour changes abruptly due provisions of floating columns. In present scenario buildings with floating column is a typical feature in the modern multi-storey G+15 construction in urban India. Such features are highly undesirable in building built in seismically active areas. This study highlights the importance of explicitly recognizing the presence of the floating column in the analysis of building. Alternate measures, involving stiffness balance of the first storey and the storey above, are proposed to reduce the irregularity introduced by the floating columns. The component backbone modelling for the concrete columns also had to change so that convergence could be reached in the SOFTWARE and the Perform-3D models.

Keywords: FEM, Staad pro, shear force, axial force, Multi stored building.

1. INTRODUCTION:

The practices of a structure throughout quakes depends seriously on its total form, dimension as well as geometry, along with exactly how the quake pressures are reached the ground. The quake pressures established at various flooring degrees in developing demand to be lowered along the elevation to the ground by the quickest course; any type of variance or interruption in this lots transfer course causes inadequate efficiency of the structure. Structures with upright troubles (like the resort structures with a couple of floors bigger than the remainder) trigger an abrupt enter quake pressures at the degree of stoppage. Structures that have less columns or wall surfaces in a certain floor or with abnormally high floor often tend to damages or collapse which is started because floor. Numerous structures with an

*MTech student, Dept of CIVIL, AVN Institute of Engineering and Technology, Hyderabad, TS, India.
** Assistant Professor, Dept of CIVIL, AVN Institute of Engineering and Technology, Hyderabad, TS, India.

open round floor meant for vehicle parking broke down or were seriously harmed in Gujarat throughout the 2001 Bhuj quake. Structures with columns that hang or drift on beam of lights at an intermediate floor as well as do not copulate to the structure, have suspensions in tons transfer course. However Provision of drifting columns relaxing at the pointer of taper looming light beams boosts the susceptibility of the side lots withstanding system as a result of upright suspension. This kind of building does not develop any type of trouble under upright loading problems. However throughout a quake a clear lots course is not offered for moving the side pressures to the structure. Side pressures collected at the top flooring throughout the quake need to be sent by the predicted cantilever beam of lights. Overturning pressures hence established bewilder the columns of the very beginning. Under this scenario the columns start to warp and also twist, leading to complete collapse. This is due to main shortage in the toughness of first stage columns, forecasting cantilever light beams and also pliable describing of beam of light column joint. There are numerous tasks in which drifting columns are taken on, specifically in the air flooring, where transfer girders are utilized, to make sure that even more open area is readily available in the first stage. These open areas might be needed for setting up hall or auto parking function. The transfer girders need to be developed and also outlined effectively, particularly in planet quake areas.

2. RELATED STUDY:

Boundary worth troubles are occasionally additionally described as area worth issues. It can be stated to be a mathematical trouble in which several reliant variables should please a differential formula anywhere within the domain name of independent variables as well as likewise please particular details problems at the limit of those domain names. The area worth troubles in FEM normally has area as a domain name of rate of interest which usually stands for a physical framework. The area variables are hence controlled by differential formulas as well as the border worth describe the defined worth of the area variables on the borders of the area. Seismic evaluation is a part of architectural evaluation and also the computation of the feedback of a building framework to earthquake. It belongs of the procedure of architectural style, quake design or architectural analysis in area where a quake is prevailing. A structure has the prospective to 'swing to and fro throughout a quake (and even an extreme wind tornado). This is 'essential setting' as well as is the most affordable regularity of constructing response. Most structure, nonetheless greater settings of reaction, which are distinctly turned

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on throughout a quake. There is even more boost in the variation for the drifting column structures compared to the normal structure. The inter-story drift additionally boosts as the boost in the variety of floor's. The floor drift is extra for the drifting column structures due to the fact that as the columns are eliminated the mass obtains boosted for this reason the drift. As the mass and also tightness enhances the base shear additionally boosts. Consequently, the base shear is extra for the drifting column structures contrasted to the traditional structures. Thus, from the research study it was wrapped up that as for feasible, the drifting columns are to be stayed clear of specifically, in the seismic susceptible locations.

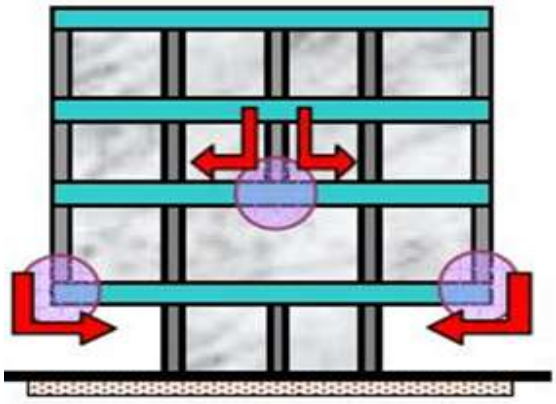

Fig.2.1.Floting Column.

Literature survey:

[1] Maison and Neuss (1984) Members of ASCE have performed the computer analysis of anexisting forty four story steel frame high-rise Building to study the influence of various modelling aspects on the predicted dynamic properties and computed seismic response behaviours. The predicted dynamic properties are compared to the building's true properties as previously determined from experimental testing. The seismic response behaviours are computed using the response spectrum and equivalent static load methods.

[2] Maison and Ventura(1991) Members of ASCE computed dynamic properties and response behaviours OF THIRTEEN-STORY BUILDING and this result are compared to the true values as determined from the recorded motions in the building during two actual earthquakes and shown that state-of-practice design type analytical models can predict the actual dynamic properties.

[3] Arlekar, Jain &Murty, (1997)said that such features were highly undesirable in buildingsbuilt in seismically active areas; this has been verified in numerous experiences of strong shaking during the past earthquakes. They highlighted the importance of explicitly recognizing the presence of the open first storey in the analysis of the building, involving stiffness balance of the open first storey and the storey above, were proposed to reduce the irregularity introduced by the open first storey.

[4] Awkar and Lui (1997) studied responses of multi-story flexibly connected frames subjectedto earthquake excitations using a computer model. The model

incorporates connection flexibility as well as geometrical and material nonlinearities in the analyses and concluded that the study indicates that connection flexibility tends to increase upper stories' inter-storey drifts but reduce base shears and base overturning moments for multi-story frames.

[5] Balsamoa, Colombo, Manfredi, Negro &Prota(2005) performed pseudodynamic tests onan RC structure repaired with CFRP laminates. The opportunities provided by the use of Carbon Fibre Reinforced Polymer (CFRP) composites for the seismic repair of reinforced concrete (RC) structures were assessed on a full-scale dual system subjected to pseudo dynamic tests in the ELSA laboratory. The aim of the CFRP repair was to recover the structural properties that the frame had before the seismic actions by providing both columns and joints with more deformation capacity. The repair was characterized by a selection of different fiber textures depending on the main mechanism controlling each component. The driving principles in the design of the CFRP repair and the outcomes of the experimental tests are presented in the paper. Comparisons between original and repaired structures are discussed in terms of global and local performance. In addition to the validation of the proposed technique, the experimental results will represent a reference database for the development of design criteria for the seismic repair of RC frames using composite materials.

[6] Vassilopoulos and Beskos(2006)Performed rational and efficient seismic designmethodology for plane steel frames using advanced methods of analysis in the framework of Eurocodes 8 and 3 . This design methodology employs an advanced finite element method of analysis that takes into account geometrical and material nonlinearities and member and frame imperfections. It can sufficiently capture the limit states of displacements, strength, stability and damage of the structure.

[7] Bardakis&Dritsas (2007)Evaluated theAmerican and European procedural assumptionsfor the assessment of the seismic capacity of existing buildings viapushover analyses. The FEMA and the Euro code-based GRECO procedures have been followed in order to assess a four-storeyed bare framed building and a comparison has been made with available experimental results.

3. METHODOLOGY:

The analysis was done by the use of E-Tabs software by using equivalent static analysis they also studied the variation of the both structures by applying the intensities of the past earthquakes i.e., applying the ground motions to the both structures, from that displacement time history values are compared .The present paper deals

with the variation of time period, displacement of structure, base shear, seismic weight of building from manual calculations and E-Tabs. It was found that floating column building is unsafe than a Normal building. The objective of the present work is to study the behaviour of multi-storey buildings with floating columns under earthquake excitations. Finite element method is used to solve the dynamic governing equation. Linear time history analysis is carried out for the multi-storey buildings under different earthquake loading of varying frequency content. The base of the building frame is assumed to be fixed. Newmark's direct integration scheme is used to advance the solution in time. A four storey two bay 2D frame with and without floating column are analyzed for static loading using the present FEM code and the commercial software STAAD Pro. Following conclusion was drawn the static and free vibration results obtained using present finite element code are validated. The dynamic analysis of frame is studied by varying the column dimension. To achieve this objective, three RC bare frame structures with G+4, G+9, G+15 stories respectively will be analyzed 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.

4. ANALYSIS MODELS:

The following are the input data of the test specimen:

Size of beam – 0.1 X 0.15 m

Size of column – 0.1 X 0.125 m

Span of each bay – 3.0 m

Storey height – 3.0 m

Modulus of Elasticity, E = 206.84 X 10^6 kN/m^2

Support condition – Fixed

Loading type – Live (3.0 kN at 3rd floor and 2 kN at 4th floor)

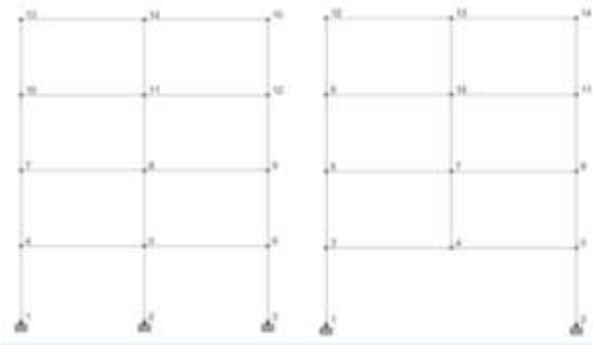

Fig.1. 2D Frame with usual columns.

Free vibration frequencies of the 2D steel frame with floating column are presented in Table 4.6. In this table the values obtained in present FEM and STAAD Pro are compared. Table 4.7 shows the comparison of maximum top floor displacement of the frame obtained in present FEM and STAAD Pro which are in very close agreement.

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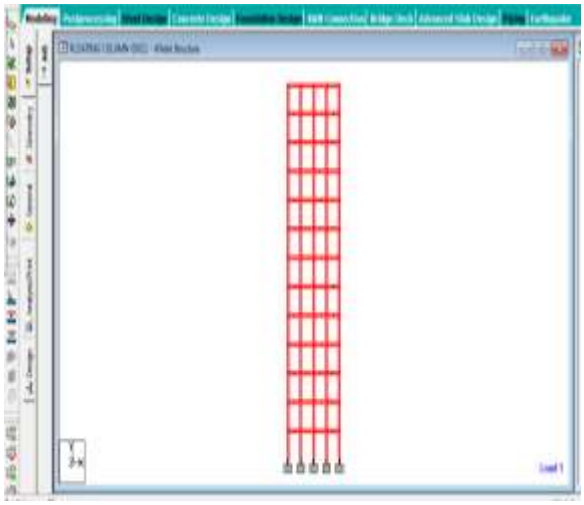

Fig.2. 3D image.

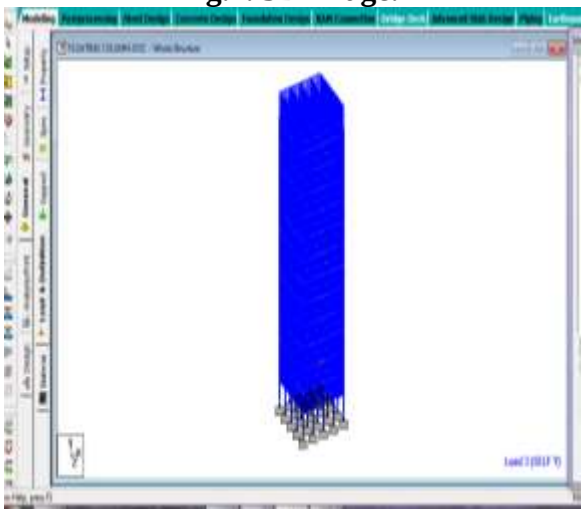

Fig.3. Dead load acting on building.

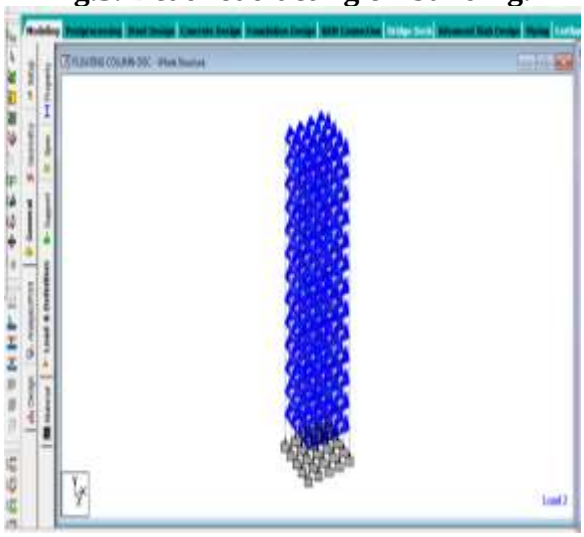

Fig.4. Live load acting on building.

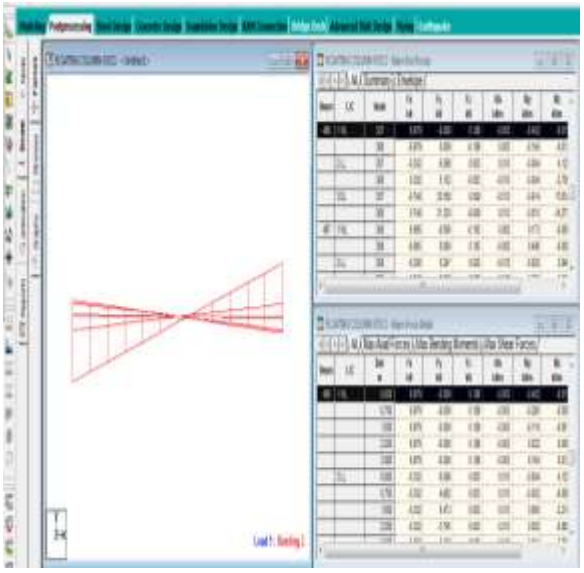

Fig.5. Bending of Beam.

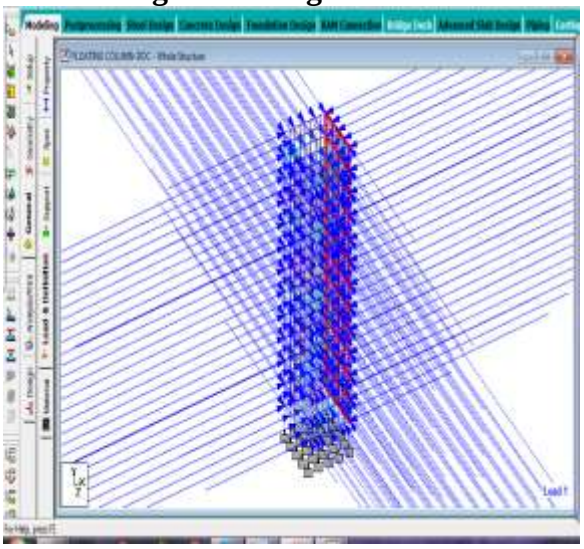

Fig.6. Wind load acting on building.

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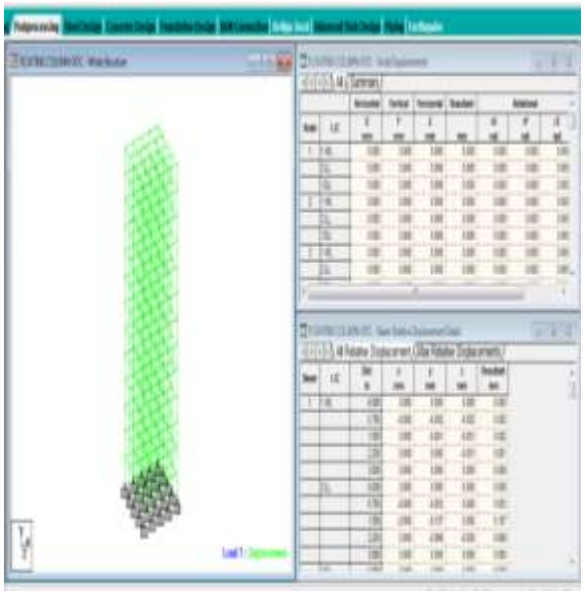

Fig.7. Displacement of Structure.

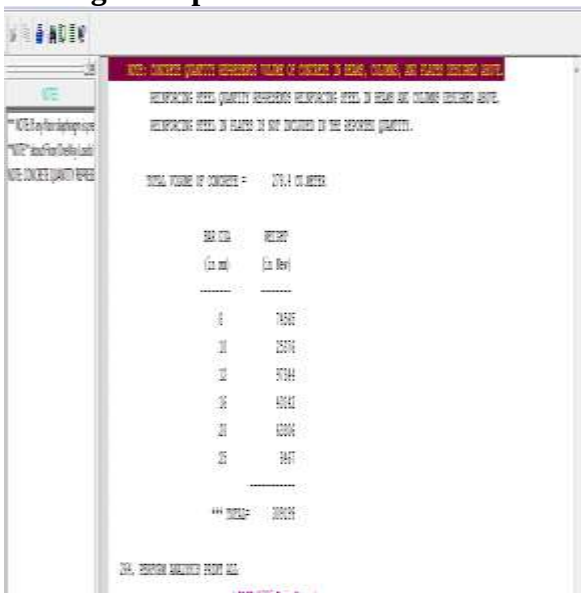

Fig.8. Concrete quantity of Structure.

5. CONCLUSION:

The behaviour of multi-storey building with and without floating column is studied under different earthquake excitation. The compatible time history and Electro earthquake data has been considered. The PGA of both the earthquake has been scaled to 0.2g and duration of excitation are kept same. A finite element model has been developed to study the dynamic behaviour of multi -story frame. The static and free vibration results obtained using present finite element codeare validated. 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.

The STAAD PRO and Perform-3D models had similar results. The effective period calculated from the Perform-3D model was in good agreement with the STAAD PRO model that utilized cracked section properties from moment-curvature analysis, only 1.7% longer. The NSP in STAAD PRO showed slightly better performance than the NSP in Perform-3D. Although the complexity in the two models thwarted expectations for exactly the same results, a property that could have affected the data output is the assignment of the rotation gage in Perform-3D. The rotation gage assignment for this study was based on the plastic hinge length anticipated at the wall's ultimate displacement capacity. In reality, the extent of hinging was constantly changing with respect to building response at each given displacement interval, and thus the rotational gages should theoretically change size in

correlation to the changing extent of plasticity. Because maximum rotations were of the greatest interest in this project, the maximum anticipated extent of hinging was decided to be a reasonable estimate for an appropriate rotation gage length.

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