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Floating Column Analysis Using E Tabs under Equistatic Analysis

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ABSTRACT: This study presents the nonlinear static analysis of a G+10 floating column structure using ETABS software, incorporating the provisions of the IS:1893:2002 code book. The analysis is conducted with three distinct models: the 1st model represents a normal reinforced concrete (RCC) structure, while the second and third models involve the removal of columns at specific locations. In the second model, columns at positions C1 and C5 on the fifth story are removed, while in the third model, columns at positions A1 and A5 on the fourth story are removed. The nonlinear static analysis is performed using the equi-static method, considering the lateral loads. The results are examined and compared for displacement, story shear, and auto lateral loads across the different models. This investigation aims to gain insights into the structural behaviour and performance of the G+10 floating column structure under varying column removal scenarios, providing valuable information for seismic design and risk assessment.

KEYWORDS: Text detection, Inpainting, Morphological operations, Connected component labelling.

I. INTRODUCTION

The seismic performance of buildings is of utmost importance in regions prone to earthquakes, as structures must be designed and assessed to withstand potentially devastating seismic forces. Among various structural systems, floating column structures architectural and spatial advantages. However, the unique design of floating columns also presents specific challenges, seismic response and stability. The focus on the nonlinear static analysis of a G+10 floating column structure, using the powerful engineering software ETABS. The analysis takes into consideration the seismic design requirements specified in the IS:1893:2002 code book, which provides guidelines for earthquake-resistant design in India. The seismic response of the building in column removal scenarios

The G+10 building represents a typical multi-story reinforced concrete (RCC) structure with floating columns, which are columns that do not extend in the building. Instead, these columns are typically discontinued at certain levels to create open spaces or architectural features. Three distinct models are developed for analysis: the 1st model represents the intact, normal RCC structure with all columns in place. The 2nd and 3rd models involve the removal of specific columns. In the 2nd model, columns at positions C1 and C5 on the fifth story are removed, simulating a selective column removal scenario on one floor. In the 3rd model, columns at positions A1 and A5 on the fourth story are removed, representing an alternate column removal configuration.

II. RELATED WORK

Elakkiyarajan, N., Iyappan, G., & Naveen, A. (2018).

The seismic response of multi-story irregular buildings has been investigated the dangerous location of floating columns in vertically uneven or asymmetrical buildings for G + 7 and G + 5 concrete structures in various seismic sectors. Building behaviors such as displacement, floor drift, and shear on specific floors were used to evaluate the final results obtained with ETABS. As beam and column sizes increase, floor displacement tends to decrease, but floor shear tends to increase. The presence of floating columns in the structure increases the drift of certain floors.

Fahimi, M., & Sreejith, R. (2015).

The behaviour of G+10 residential building. Various building models of STAAD Pro software and analysis done using static method. The systematic building models comprises of all the modules which effect the mass, deformability, stiffness and finally the strength of structure. The structural building system consists column, wall, beam, elevator, staircase, slab, footing and retaining wall. The results shows the column shear changes in accordance with the condition and location of column, also the curvature at every single floor or storey rises, shear force gradually rises but it is almost equivalent at every floor for respective columns. explores the effects of disjointedness column in a building exposed to seismic forces.

Jain, D., & Maru, S.

In their study of performance of column in seismic analysis, multistorey concrete building performed the analysis and evaluation of building with and without floating column in higher seismic prone zone. 4-models were created by changing the place of floating column. Linear static is performed. For this, buildings were provided floating columns at one or more storey. Floating columns were highly disadvantageous in a building are built where seismically active area. In the project studies the analysis of G+5, G+7, G+9, G+11 and G+13 with floating column and without floating was carried out.

Maitra K. & Serker N. K. (2018).

They carried out an analysis of G+5 storey structure using ETABS 2016 software. The author has also compared it with, Response Spectrum Analysis. Models were considered for analysis. Model -1 was the conventional model, Model-2 was introduced with FC at the outer edge of 1st floor and in Model-3 FC were placed at the 5th floor at the outer edge. The results were taken for Zone 4 with medium soil conditions. The Author calculated Maximum Reactions, Maximum Story Displacement, maximum base shear, and Maximum Story Drift using Response Spectrum Analysis. The present research says that maximum storey displacement in the lateral direction was maximum in model which had floating columns on their edges. Also, Value of vertical reaction was increased with increase in story height

III. METHODOLOGY

A nonlinear static analysis is required for any static application in which the stiffness of the entire structure changes during the loading scenario. The simulation must be solved incrementally for the stiffness changes.

There are three situations in which the stiffness of a structure changes,

1. The deformation of the structure is so large that equilibrium must be considered at the deformed position rather than the original position.
2. The material’s mechanical properties change during loading, in other words the internal stress does not remain directly proportional to the internal strain caused by the external load. This is the case for materials that display plastic or hyper-elastic behaviour.
3. Changes in physical contacts allow stress transfer between structural components.

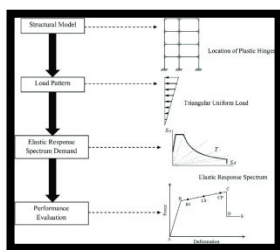


Fig-3.1 Building description

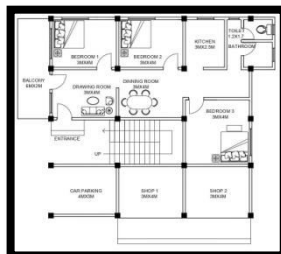


Fig-3.2 2D plan

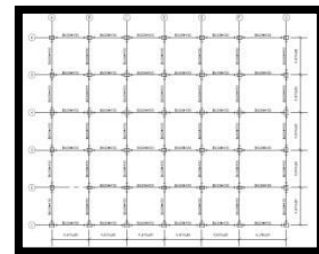


Fig-3.3 Beam & Column plan

MODELING AND ANALYSIS

Model-1

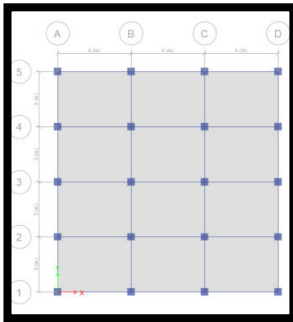


Fig-32Dwireframe

model-2

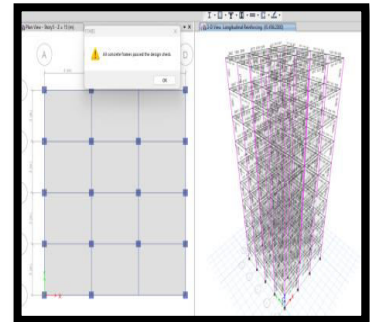
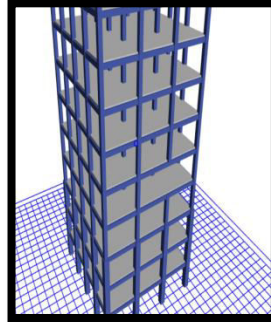
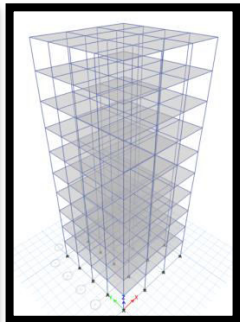


fig-3.2 column removed

Model-3

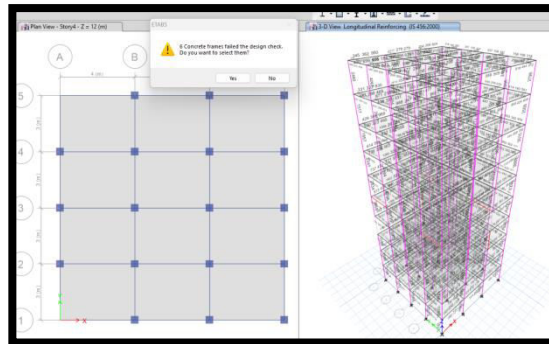
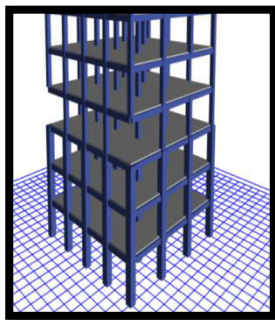


Fig-Column removed @A1&A5@storey@ STY 4, Failed design check and 6 concrete member

IV. EXPERIMENTAL RESULTS

Figures The below table and chart are shown the result of all 3 models along the X and Y direction. This table and bar chart are compared all the 3 models maximum story displacement, maximum story dirft, story shear along the X and Y direction.

MAXIMUM STOREY Displacement

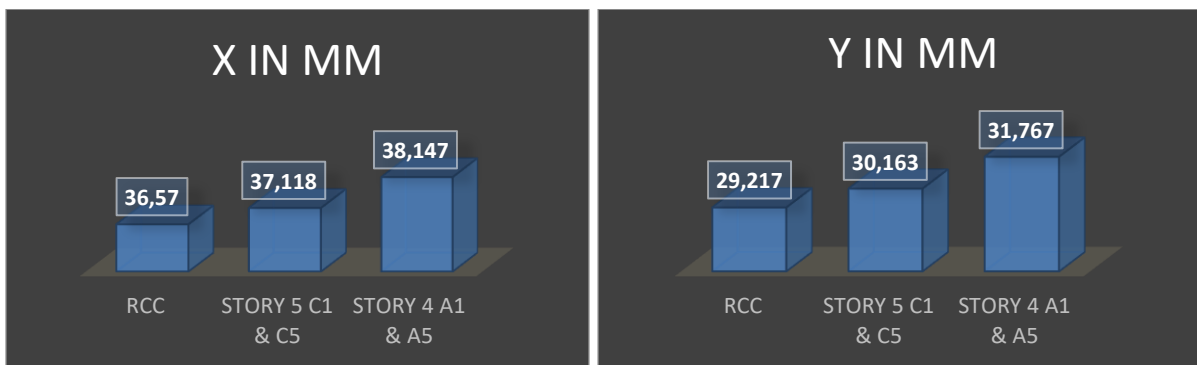


Fig-4.1 Max Storey displacement along x and y direction of all 3 models

MAXIMUM STOREY SHEAR

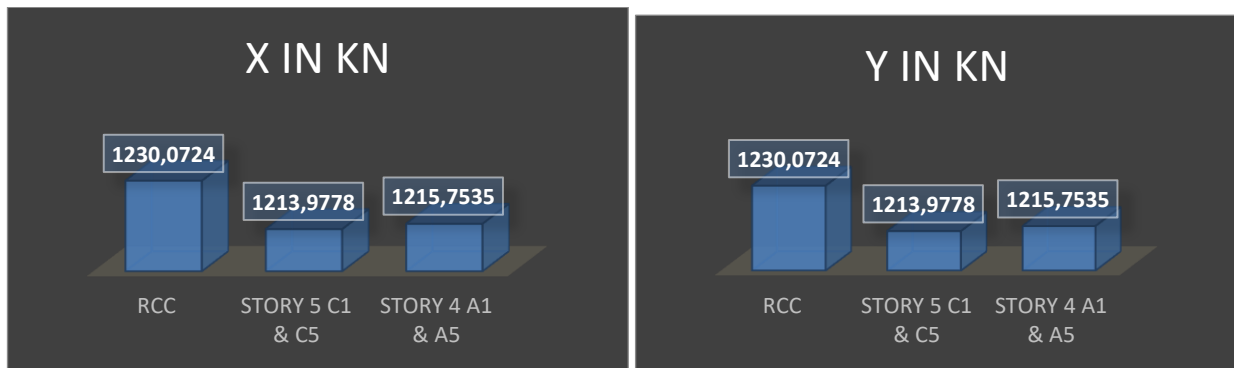


Fig-4.2 Max Storey Shear along X and Y Direction of all 3 models

Maximum Autolateral loads

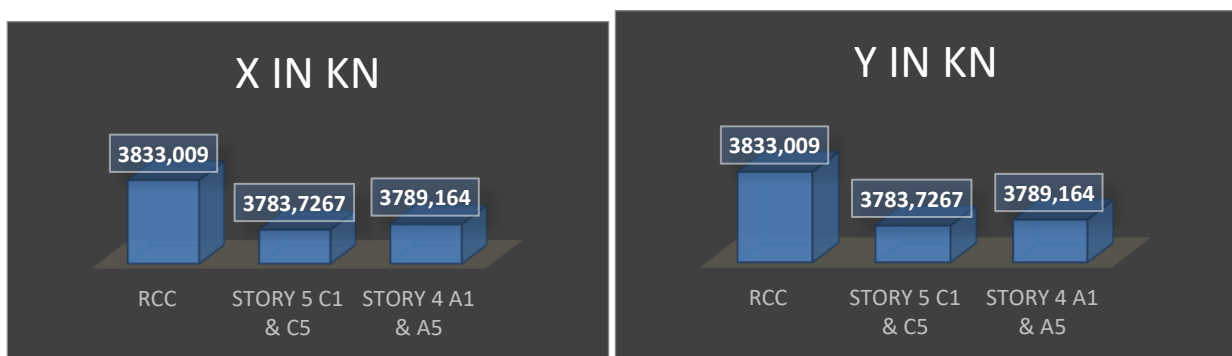


Fig-4.3 Max Autolateral load along X and Y direction of all 3 models

V.CONCLUSION

Considering the above maximum storey, storey shear, autolateral loads and findings the preferred option would be the normal RCC model or the model with column removal at C1 and C5 at storey 5. Both of these models have shown satisfactory performance in terms of displacement, story shear, and auto lateral loads. Ultimately, the failed model with column removal at A1 and A5 at storey 4 should be discarded as it does not meet the safety criteria. The decision should be based on the expert analysis and professional judgment to ensure the integrity and stability of the building

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