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Comparitive Analysis of Floating columns using Conventional Analysis and Construction Sequence Analysis

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ABSTRACT: In earlier days the multistoreyed buildings have been analysed as a complete frame in a single step. In this case all the loads like the self weight, super imposed load, live loads and lateral loads will be applied on the frame at a given time, after the construction of the entire frame is completed. In actuality, the dead load and imposed loads are applied in separately as the structure is constructed storey by storey. The behaviour of the structure is different when various loads are applied in a single step and applied in stages. Therefore, in order to assess the actual condition of the frame, taking into account the various loads, the frame should be analysed at every stage of construction. This phenomenon is called as Construction sequence Analysis.

In this project two models have been created with different column positions. Results are compared for both Conventional and Construction Sequence Analysis for parameters like bending moment, shear force and displacement using ETABS Analysis.

KEYWORDS: Construction sequence Analysis, Floating column, Conventional Analysis, ETABS Analysis, Bending Moment, Shear force, Displacement.

I. INTRODUCTION

A column is a vertical compression element that extends from the base to the roof level. A floating column is a vertical element that rests at its bottom level on a beam or transfer girder. Many buildings include floating columns above the ground storey that are supported by transfer girders, allowing open space in the below storey. Floating columns may withstand gravity loads, but the transfer girder must be of sufficient size, analysed, designed and detailed with minimal deflections. Construction Sequence Analysis is required to increase the accuracy of the analysis in terms of displacement, bending moment, and shear force in nearby supporting beams and columns, as well as the entire structure. Conventional analysis is important as it provides a basis for structural design. Comparison is done to show that the construction sequence analysis is necessary in the analysis of Multistoreyed building.

II. LITERATURE REVIEW

1. **Das and Praseeda [1]** analysed a commercial building of 2B+G+6 for construction stage analysis and conventional analysis. For construction stage analysis, the case study building is modelled in ETABS. The study takes into account deformation, bending moment, and construction stage analysis.
2. **Rao et al. [2]** In zone III, he compared the results of traditional and sequential analyses on the LB+UB G+22 storeyed building. Floor-to-floor building cycle time and concrete strength are the two key criteria examined in this study. The transfer girder and the frame above the transfer girder are analysed and compared.
3. **Naxane et al. (2017)** looked at how different configurations affected the effect of sequential assembly on a rigid frame. These structures were analysed for sequential loading, and the findings were compared to a one step analysis having the identical configuration. Axial force, shear force, axial deformation, and bending moment variations were analysed. When compared to linear static analysis, the structural conclusions produced via construction sequence analysis were more. This is most likely due to staged construction



4. **Shirhatti and Vanakudre [3]** For two construction materials, RCC and steel, researchers looked at the effects of linear static analysis, time dependent analysis, and construction sequence analysis. Three-dimensional modelling and analysis results for a 30-story concrete and steel buildings have been completed

III. OBJECTIVE

- The objective is to reduce the potential for structural failure during the construction time ultimately reducing the risk of injuries and delays construction projects.
- To compare the parameters, i.e. bending moment, shear force & displacement of the transfer beams by Construction sequence analysis and Conventional Analysis.
- To study and compare between the conventional analysis and construction sequence analysis of the behaviour of a G+15 storeys RC building with floating columns at two different locations using ETABS software.

IV. METHODOLOGY

- In this study a G+15 multistoried building is considered with two different positions of floating columns. The modelling and analysis of work is done by using ETABS (Extended Three Dimensional Analysis of Building) software.
- This building considered is analysed using two methods, Conventional Analysis and Construction sequence analysis of Floating Columns at (i) At ends (ii) At corners
- In Conventional analysis, the building is analysed using the single-step method. In this method, it is assumed that the structure is completed and the loads are applied only after the construction is completed. Here the model is analysed by Static case.
- In Construction Sequence Analysis, the building is analysed at each story and the loads are applied to each story as the construction progresses, simulating the actual behaviour of the structure. Here the model is analysed for self weight and the construction loads with minimum live load.

V. MODEL DESCRIPTION

- A standard RC frame building model is created with different floating column positions in ETABS.
- Analyse the structure for Conventional Analysis (Static Analysis) and Construction Sequence Analysis
- Analyse the models created.
- The analysis is done and the results are compared.

Table 1: Structural Details

Type of building	RCC
Floor to floor height	3 m
Building dimension	(20X16) m
Number of Storey	G+15
Type of steel	Fe- 500
Grade of concrete	M-25, M-30
Thickness of wall	230 mm
Slab thickness	125 mm
Live load	3.0 kN/m ²



Floor finishes	1.5 kN/m ²
Construction Loads	5.0 kN/m ²
Wall load	11.73 kN/m
Partition wall load	5.87 kN/m
Building height	45 m

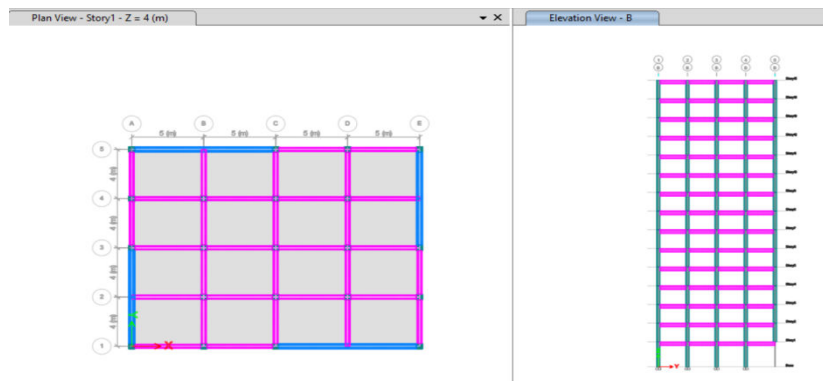


Fig 1 Plan and elevation at B of Model 1

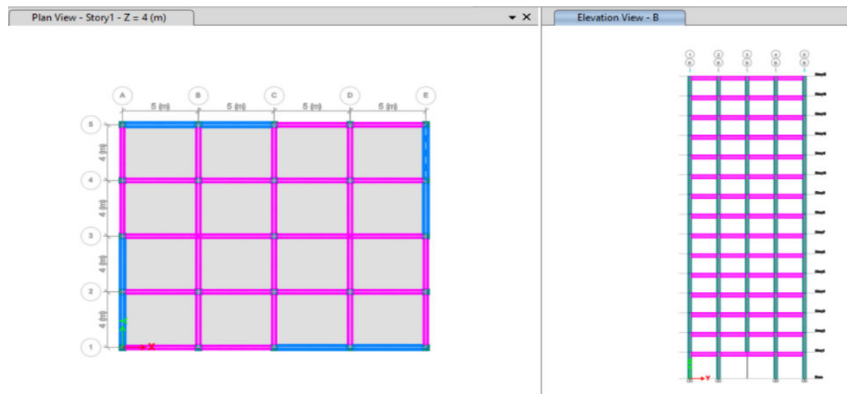


Fig 2 Plan and elevation at B of Model 2

TABLE 2: Model Details:

	Model no.	No. of stories	Description	Height
Case 1	1	G+15	Model with Floating columns at sides with Conventional Analysis	45m
	2	G+15	Model with Floating columns at centre with Conventional Analysis	45m
Case 2	3	G+15	Model with Floating columns at sides with Construction Sequence Analysis	45m
	4	G+15	Model with Floating columns at centre with Construction Sequence Analysis	45m



- Load Case details

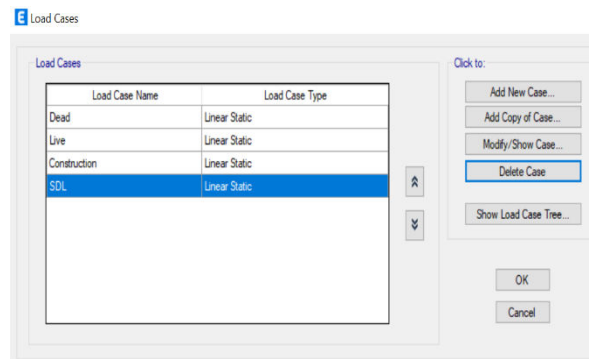
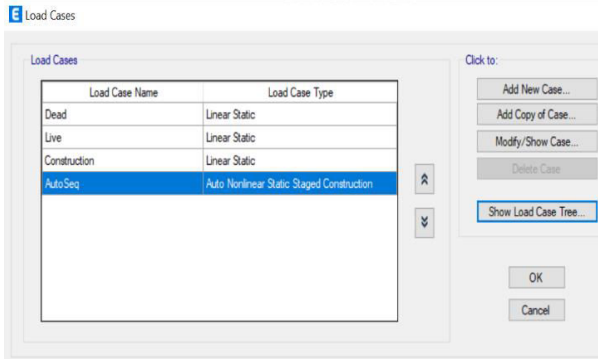


Fig 3: Load Case for Construction Sequence Analysis

Fig 4: Load Case for Conventional Analysis

VI. RESULTS

CASE 1) Building with Floating columns at sides:

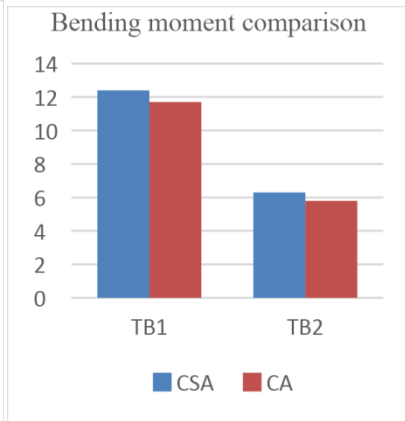
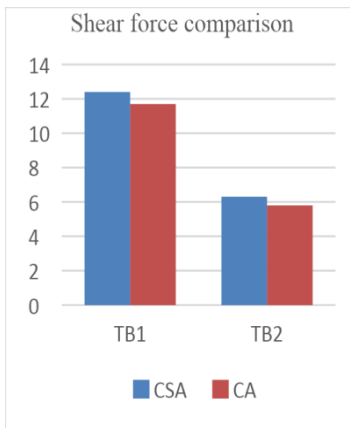
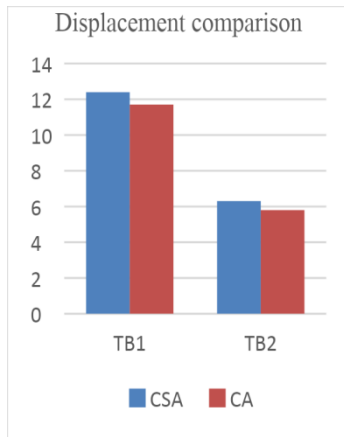


Fig 5: Bending moment comparison

Fig 6: Shear force comparison

Fig 7: Displacement comparison

CASE 2) Building with Floating columns at the centre

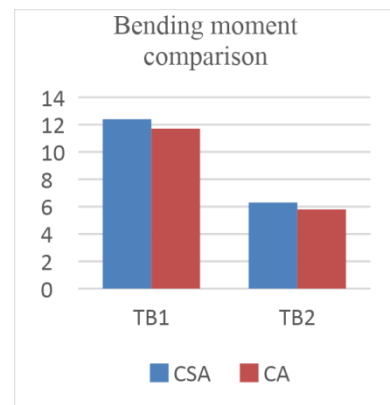
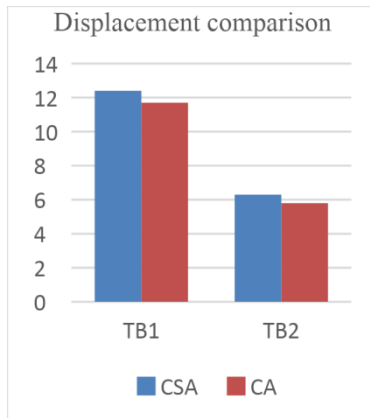
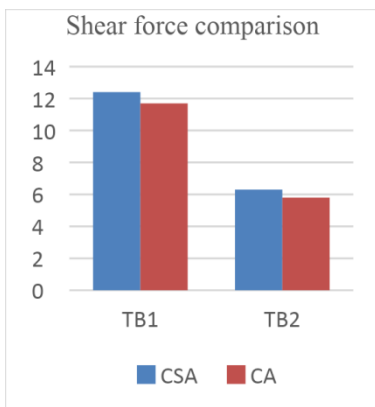


Fig 8: Bending moment comparison

Fig 9: Shear force comparison

Fig 10: Displacement comparison



VII. CONCLUSION

- From the above analysis it is found that construction sequence analysis should be performed for Multistoreyed Buildings with floating columns.
- At the initial stages of the building with the given data, construction sequence analysis has to be used to fix the initial building parameters such as column and beam sizes.
- The moments and Shear forces obtained in the transfer girder in construction sequence analysis is more compared to moments obtained in Conventional Analysis with similar load case.
- The deformation of the floating column on the sides is greater than that of the column in the middle.
- Construction loading is an important to be considered in Multistoreyed buildings.
- There is a possibility of deflections in the in the lower floors as the construction progresses above, which in turn will affect the finishes.
- Construction Sequence Analysis is an analysis methodology in which the actual loads are applied when the construction takes place and cannot be ignored.
- In the above results the similar load cases comparisons are made between Construction Sequence Analysis and Conventional Analysis.
- The maximum moment obtained from the static analysis for the transfer beam is lesser than the Construction Sequence Analysis results, hence it shows that the Construction Sequence Analysis has to be performed.

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