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Construction Stage Analysis on Mesh Tube Structural System Building

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A B S T R A C T

The structural analysis of multi storied buildings is one of the areas that have attracted a number of engineering researchers and designer's attention. There is one area, however, which has been ignored by many previous investigators, i.e., the effects of construction sequence in a multi-storey building analysis. That is while analyzing a multi-storey building, conventionally all the probable loads are applied after modelling the entire building. But in practice the building is constructed in various stages. Accordingly, the stability of frame varies at every construction stage. Thus, the loads assumed in conventional analysis will vary in transient situation.Obviously, results derived by the traditional analysis will be incompatible. Therefore, the building should be analyzed at every construction level taking into account variation in loads.It is observed that at the effect of the formation sequence increase with the increase in storey.Therefore, the effect of a construction sequence cannot be neglected and a precise analysis should be conducted. The phenomenon known as Construction Stage Analysis reflects these uncertainties accurately.

In this study construction sequential analysis has been studied on tube in tube structure. For this purpose, a tube in tube structural system building with different heights (G+40, G+45, and G+50) has been considered for comparative study. The plan dimensions of the building are 24

m x 35 m. The structures were modeled and analyzed by using ETABS software. Construction sequence is considered for dead load only. Also, the structure is analyzed for linear static analysis in order to check the stability of the structure as per Indian standards and then the structure is analyzed for construction sequence analysis. The variation in Storey displacements, Column axial forces, bending moments and Shear forces of beams and columns were compared to know the construction sequence analysis effect on tube in tube structural system building.

Keywords: Construction sequential analysis, ETABS, High-Rise structure, Mesh Tube structural system.

1. INTRODUCTION

The tube structural system is utilized, to withstand lateral loads (wind, seismic, impact). The tube structural system structures are constructed to perform like a hollow tower (i.e. Cantilevered column perpendicular to the surface. Thisstructural system was inaugurated by Fazlur Rahman Khan while at the architectural firm Skidmore, Owings & Merrill (SOM), in their Chicago office. The primary illustration of the Tube structural systemic used in the 43-story Khan-designed DeWitt-Chestnut Apartment Building, since renamed Plaza on DeWitt, in Chicago, Illinois, finished in 1966. The tube structural system can be constructed using steel, concrete, or composite construction materials (the discrete use of both steel and concrete). It can be manipulated for office, apartment, and mixed-use constructions.

1.1 Objective of Study

To understand the high-rise structure behavior Analytically during construction at different stages using Construction sequence analysis.

1. To study the performance of mesh tube structure during Construction Sequence

analysis.

2. To know the effect of construction sequence analysis in various structural parameters like deflection, Bending moments, shear force and axial force of the structural elements.

3. The Scope of work is limited to detailed analytical study on Construction sequence Analysis of high-rise buildings using ETABS software for three different heights of Buildings as G+35, G+40, and G+45 storied tube in tube structure.

1.2 Scope of study

In order to observe the Construction sequence analysis effect on the Tube in Tube structure, G+35, G+40, and G+45 storey building models are considered in this study.The plan dimensions of the building are 45 m x 72 m. The structures were modelled and analysed by using ETABS finite element software.

Construction sequence is considered for dead load only. After conventional analysis Construction sequential analysis is done.Table 1 - An example of a table

2. Modeling of the structure

The structural models must allow to consider the effects of movements and deformations in those structures or part thereof, where second-order effects increase the effects of the actions significantly. The modelling of the entire structure is done in ETABS software.Section headings Step by Step procedure for construction sequence analysis:

Step 1: Select new model and a window appears then enter the details of grid (i.e. number of grids in both X and Y and spacing between each grid in both X and Y direction and then define number of stories of the structure. Here the program had generated 2D and 3D grid based on the specified the grid details.

Step 2: After creating the grids, then define the material properties required for the Page 19 of 50 structure.

Step 3: After that define the section properties (beams, columns, slabs, and wall) required for the structure.

Step 4: After defining the property for materials and section properties, now draw the structural components of the structure by using draw tools.

Step 5: Then assign the supports at the base of the column by going to assign menu→joint\frame →Restraints (supports)→fixed.

Step 6: Once modelling structure is completed then define load patterns, load cases and load combinations as per Indian standards by going to define command and then define load patterns, cases and combinations.

Step 7: After that assign quantity of the dead, live loads on the structural elements.

Step 8: Then analyze the structure for linear static analysis to check the weather the structure and structural elements are within the limits as per Indian standards

Step 9: Once the provided structural are safe as per codal requirements then we define auto construction sequence case for that go to Define > auto construction sequence case

Step 10: Check Model: Analyze > Check Model

Step 11: Run Analysis: Analyze > Run the Analysis.File naming and delivery

3. Results and Discussion

In this present chapter, the results acquired for distinct building models for construction sequential of analysis executed particularly. This building model is assumed to be located in seismic destructive zone II,Visakhapatnam. The basic wind speed is 50m/sec. The structure is composed of special moment resisting frame (SMRF). Structural elements are analyzed according to Indian Standards. After Linear static analysis has done for the checking of the stability structure, then construction sequence analysis (CSA) is considered. The evaluation is carried out by using ETABS software. And then the structural analysis results of the building are studied such as axial force, shear force, bending moment of the structural frame elements and story displacement of the structure.

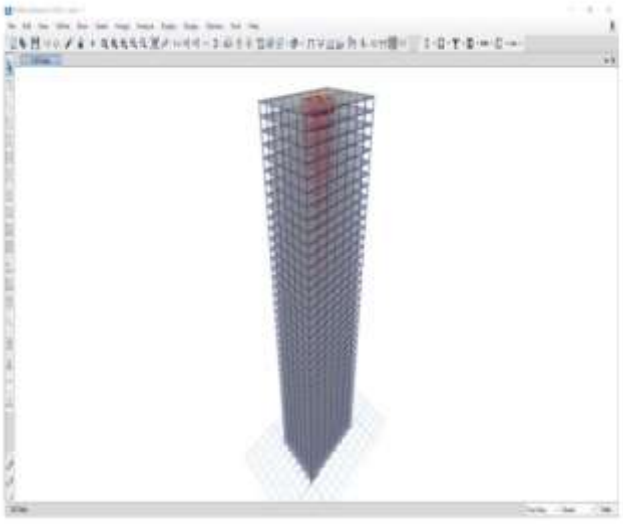

Fig.1 -3D Rendering view of the structure

4. Conclusion

Construction sequential analysis is becoming an essential part during analysis as much well recognized analysis software included this facility in their analysis and design package. However, this nonlinear static analysis is not so popular because of lack of knowledge about its necessity and scope. Like so many other analyses, construction sequential analysis had specific purposes in design phase of the structures. As it is mentioned earlier, it deals with nonlinear behavior under static loads in the form of sequential load increment and its effects on structure considering the structural members are started to react against load prior of completing the whole structure. In this project Construction sequence analysis of mesh tube structure with various stories (G+40, G+45 and G+50) are studied. It can be concluded from all the above observations that:

In conventional analysis the load is applied only after modeling the entire structure. But the dead loads are of sequential nature in reality. So, from this we can conclude that conventional analysis is not enough to find out the actual behavior of structure.

- From the results it is found that the variation of results is over estimated for upper floors and under estimated for lower floors.
- The study reveals the necessity of performing nonlinear static analysis becomes important with increasing slenderness while each additional floor creates a significant load upon the columns.
- It is evidenced that simulation of sequence of construction in the analysis leads to considerable variations in deformations and design forces obtained by conventional one step analysis.
- After construction sequence analysis the structural displacements are within the limits. From this we conclude that the mesh tube structure gives better resistance to the external applied loads on it.

References

1) Analysis of Multi-Storey Structures Using Sequential Analysis – A Review By Nikunj D. Banugariya

2) Study And Comparison Of Construction Sequence Analysis With Conventional Lumped Analysis Using Etabs By R. Pranay

3) Effect Of Sequential Construction On Multistoreyed Building By Dr. Suchita K.Hirde

4) The Construction Stages Of The Six-Storey Residential Building In Saint-Petersburg By Mariia Panfilova

5) Chronological Construction Sequence Effects On Reinforced Concrete And Steel Buildings By Yousuf Dinar