Effect of Construction Sequence Analysis on RC Building Structure

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Abstract **- Rising incidents of failure of buildings during the construction phase is an increasing concern in India. The failure of structural elements like slabs, beams, columns, and shear walls is critical. Construction sequence analysis (CSA) helps in analyzing the building in a staged fashion. This study analyzed the values of structural parameters of a 10 storied building is measured these results against the dynamic analysis of the building. The values of deflection and shear forces found in CSA are up to 35% more than dynamic analysis. This study definitively answers the question regarding the failure of buildings during the construction phase and how it can be avoided by using CSA. This study definitively answers the question regarding the failure of buildings during the construction phase and how it can be avoided by using CSA.**

Index Terms **- Construction sequence analysis, conventional method, E-tabs software.**

I.INTRODUCTION

While analyzing tall structure in Conventional method the gravity loads are applied after modeling the whole structure. In actual practice the complete frames are constructed at various stages and the stability of frames varies accordingly. The applied load assumed in Conventional method will be unsuitable as per the actual construction practice. The frame should be analyzed at every construction stage considering the effect of variation of loads at each stage. This methodology is known as construction sequential analysis. A failure of the structure during construction is most vulnerable. During the construction process failure of the structures or partially completed structures often occurs. It is not necessary that the collapse of the structure is due to construction error. It may be due to lack of information during design. Generally, finite element analysis with linear static elastic method has been considered for calculation of summations of vertical column loads to determine the behavior of structures. As the construction of tall building goes on increasing with height in construction phase, the typical approach of analysis for various structural responses like Deflection, Axial loads; Shear Force and Bending Moments may have diverged from the actual behavior. During analysis it was unable to consider so many parameters that are complex in nature. But due to advance method of finite element modeling and simulation, nonlinear analysis became very easy to accelerate proper design of structures especially high-rise.

II. LITERATURE REVIEW

Tabassum G Shiri Hatti (2015).,et,al,: In this research she is carried out g+30 storey building is modeled analyzed in etabs software. She analyzed for two different materials are concluded ie model with rcc and steel. She observed that the outcome is obtained from the moment due sequential analysis with p-delta are most important that they compare to linear - static analysis.

Prof, Laxmi Kant vairagade, et, al : In this paper he documents the model with varying height has been considered. He analyzes with conventional, and construction sequential analysis had been conveying them to perform carry out in his research. It is conveyed that from the results bending moment is much more in sequential analysis compared to conventional analysis, and difference in shear force and axial load.

III. OBJECTIVES

- To study the behavior of high-rise structure analytically at different stages using construction sequence analysis.

- Comparative study of Construction Sequence analysis with the conventional method.
- To study the percentage, change in the values of various structural parameters such as deflection, Bending moments, shear force and axial force of the structural elements with conventional method and Construction sequence analysis**.**

IV. CREATION OF A MODEL USING ETABS

The dimension of the building are 12mt x 35mt. In elevation building has G+10 floors with each floors having height of 3.5mt. Hence total height of building 36. 5mt.The plan of the building as follows.

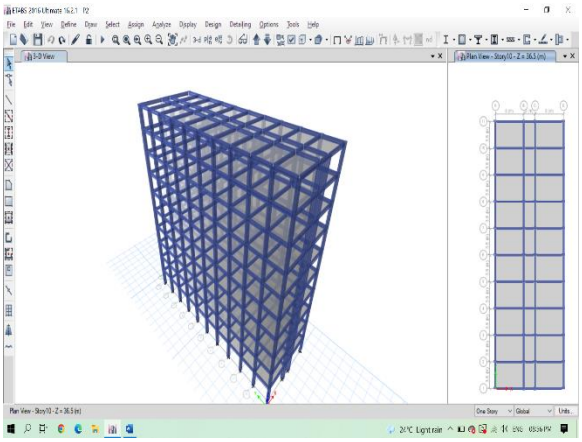


Fig 1.1 shows 3D modelling

No of stories	10
Soil condition	Medium
Frame type	OMRF
Response reduction factor	5
Seismic condition	ii
Importance factor	1.5
Zone factor	0.1
Concrete grade	M30
Grade of steel	HYSD500
Column	300x600mm
Outer beam	230x450mm
Inner beam	230x375mm
Internal wall	115 mm
Exterior wall	230 mm
Height of each story	3.5m
Total height	35m
Plan dimension	12x35m

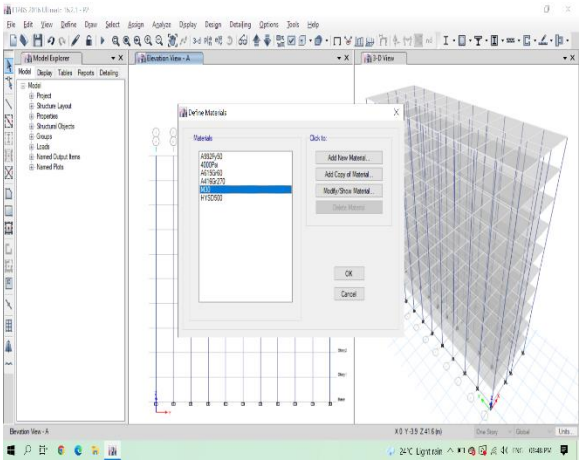


Fig 1.2 shows material defining

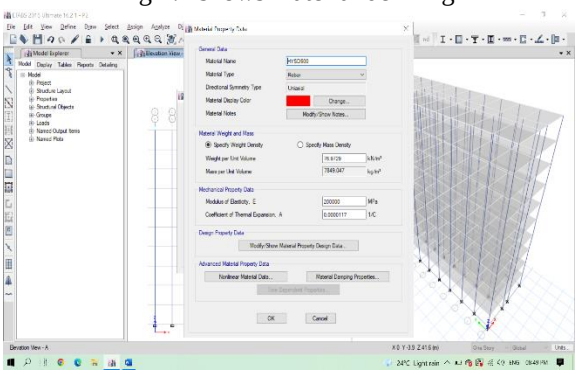


Fig 1.3 shows material defining

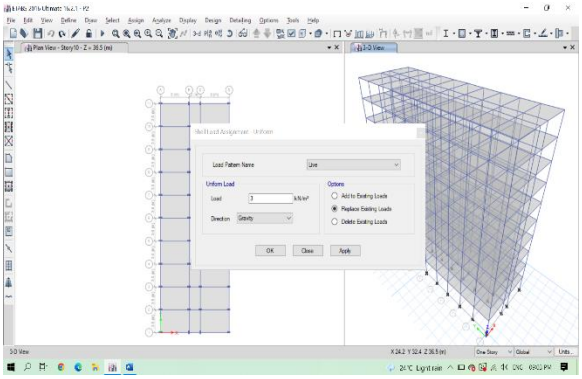


Fig 1.4 shows slab dead Load assigning

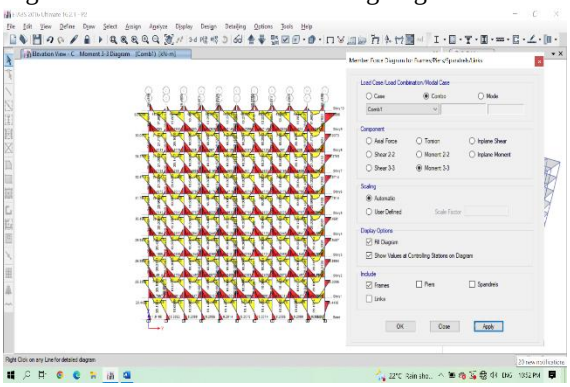


Fig 1.5 shows bending moment

V. MODELLING OF CONSTRUCTION SEQUENCE ANALYSIS

CSA is a method in which a structure is analyzed in sequential form. It is a nonlinear analysis method. The loads are partially applied on the structure at each stage. This story wise loading ensures that the values generated are more realistic and can be trusted over conventional methods. Following are steps to analyses construction sequence analysis.

The results generated by the conventional analysis method are markedly different from the actual results. Which may lead to the failure of the building during the construction phase. To overcome this assumption a method is called 'Construction sequence analysis (CSA)' is developed. Following are the steps to be fallowed analyzing the CSA method.

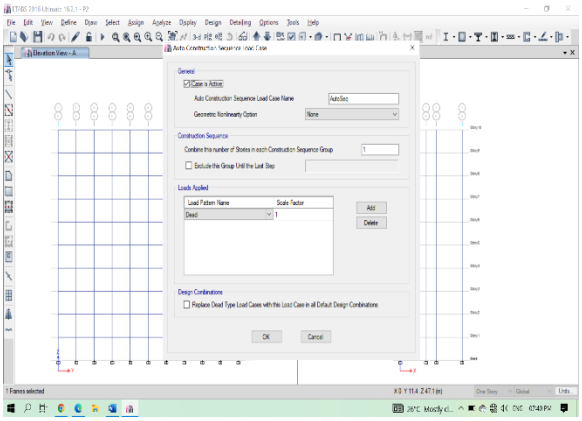


Fig 1.6 shows Auto sequence Loading

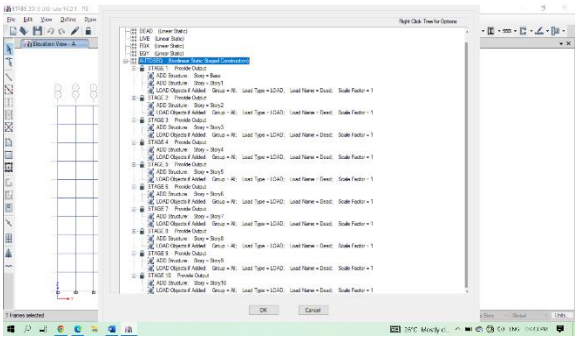


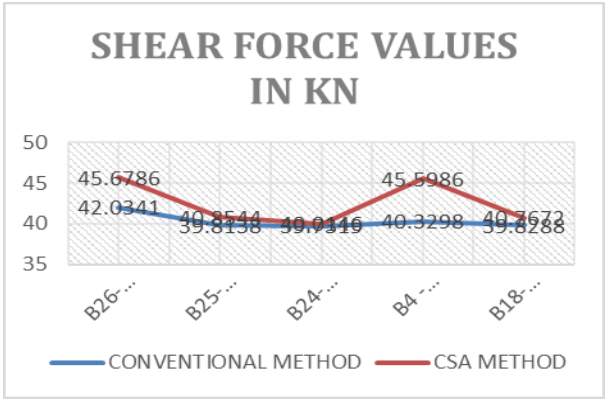
Fig 1.7 shows Auto sequence Tree Loading

VI. RESULTS AND DISCUSSION

This chapter presents the results from the current study. The structural design is in consistence with IS 456-2000 and IS 1893. The members are design as ordinary members. The difference in the behavior in Conventional method and CSA method results as Bending moment and shear force, axial force, displacement are discussed in this chapter.

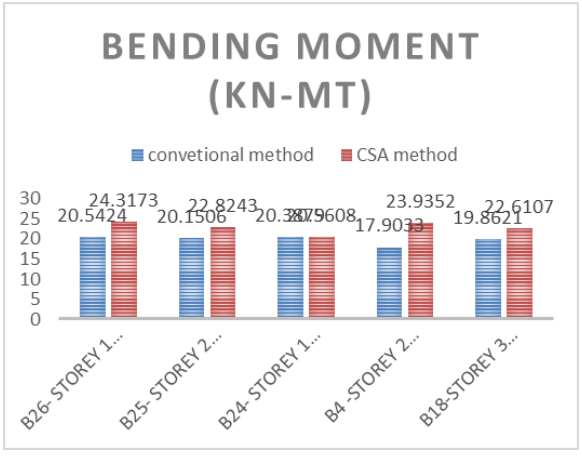
1) Shear Force Values Differences In Conventional and Csa Method.

Most vulnerable beam	SF value conventional analysis	SF value of CSA
B26- STOREY 1 (VIEW-A)	42.0341	45.6786
B25- STOREY 2 (VIEW-A)	39.8138	40.8544
B24- STOREY 1 (VIEW-A)	39.7319	40.0146
B4 -STOREY 2 (VIEW- D)	40.3298	45.5986
B18-STOREY 3 (VIEW-A)	39.8288	40.7672



2) Bending Moment

Most Vulnerable beam	BM of conventional analysis	BM value of CSA
B26- STOREY 1 (VIEW-A)	20.5424	24.3173
B25- STOREY 2 (VIEW-A)	20.1506	22.8243
B24- STOREY 1 (VIEW-A)	20.3879	20.5608
B4 -STOREY 2 (VIEW- D)	17.9033	23.9352
B18-STOREY 3 (VIEW-A)	19.8621	22.6107



VII. CONCLUSION

- It is found that the behavior of high-rise structure analytically at different stages using construction sequence analysis
- It is observed that obtained results generated by the conventional analysis method are markedly different from the CSA method.
- The values of shear force and bending moment are different in conventional and construction sequence analysis.
- It's clearly observed that story displacement is maximum in conventional method as compared to CSA method.

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