

Construction Sequential Analysis for (G+10) Multistoried Building by using ETABS

Dhiraj Gunwant Wankhede¹, Prof.Mandar M. Joshi²
 ME-Student (Structural Engineering) Department of Civil Engineering¹,
 Assistant Professor, Department of Civil Engineering²
 Email: dhirajwankhede205@gmail.com¹, mandarjoshi1608@gmail.com²

Abstract- Practical knowledge is important for every engineer. For obtaining this skill, a multistoried building is analyzed and designed, assumed in Buldana, Maharashtra with (G+10) storey by using ETABS-2016. For design this building construction sequence is considered because it's becoming an essential part during analysis. Construction sequence is necessary because generally buildings are analyzed in a single step using linear static analysis but in reality dead load, imposed load are being vary storey by storey due to the non-linear behavior of materials. Present study deals with the study of construction sequence on multistoried building considering dead load, live load, earthquake force, wind load. And study of pushover analysis is also being done. But main aim is to study the comparative results between conventional and construction sequence analysis.

Index Terms- Construction sequential analysis (CSA), construction load, lateral load, **sequential** loading, ETABS

1. INTRODUCTION

Construction sequence analysis is a more practical and accurate method of analysis, due to the consideration of load which is applied on the frame in various stages, for the analysis of deflection strength, and stability at the completion of each step. Also the order in which various components of the building are constructed is important. At the time of structural analysis of multistory buildings, there are two important factors which are very important for precise analytical results but usually they are ignored in practice. They are: (1) the effect of construction sequential application of dead loads due to the sequence of construction and (2) differential shortening of column due to the variation of gravity load areas.

As it is stated earlier, Construction sequence analysis deals with nonlinear behavior under static loads in the form of sequence construction load increment which effects on structure and structural members after completing the whole structure. For auto construction sequential analysis one of the leading analysis software “ETABS (Extended 3D analysis of building systems) Version 9.7.4” is used and all displacement outcomes are measured in mm and moment and axial load are measured in KN-M and KN respectively

2. RESEARCH METHODOLOGY

In this paper, effect of construction sequence analysis is carried out on the multistoried building and the plan and elevation of that building is shown in figure 1 & 2. The details of building models are given in table 1.

The performance of a structure with all the various loads applied in a single step change significantly

from that when the loads are applied in the sequence of stages. So for finding out the actual condition of load during the construction of the frame, the frame should be analyzed at every construction stage and this phenomenon is known as Construction Sequential Analysis which is used to analyze the structure storey by storey.

A Multistoried building has been analyzed by using linear static method and construction sequence method with the help of ETABS. All models are analyzed to find out the maximum displacement, storey drift and shear force. The coefficient which is required for analysis and design purpose providing as per accordance of IS 456-2000, IS 800-2007, IS1893-2002, UBC-97(For Wind Load). The building was assumed in Buldana city of Maharashtra in the territory of India. The details of building model are as follows.

Table 1. Details of Building Model.

Sr.No.	Title	Description
1	Height of Building	30.2
2	Size of Beam	300 X 650
3	Size of Column	750 X 900
4	Soil Type	Medium Stiff
5	Importance Factor	1
6	Building Frame System	Special RC Moment-Resisting System
7	Zone Factor	0.16
8	Wind Speed	39m/sec
9	Height of Storey	3.2 for Ground Storey and 3 for remaining storey
10	Earthquake Zone	III

11	Grade of Steel	Fe 415 and Fe500
12	Grade of Concrete	M30

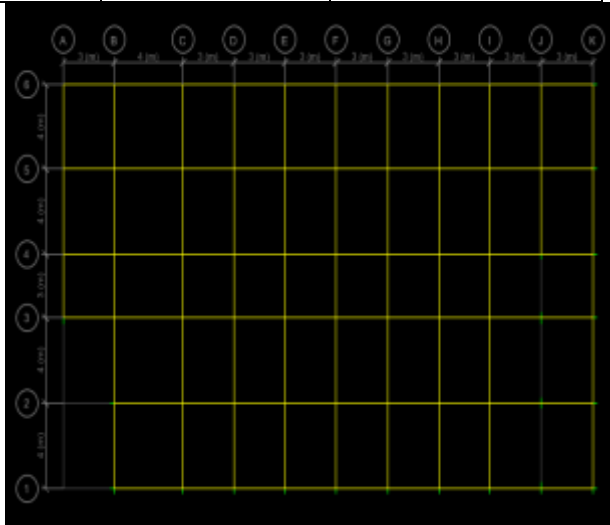


Figure No. 1. Plan for 10 Storey building model.

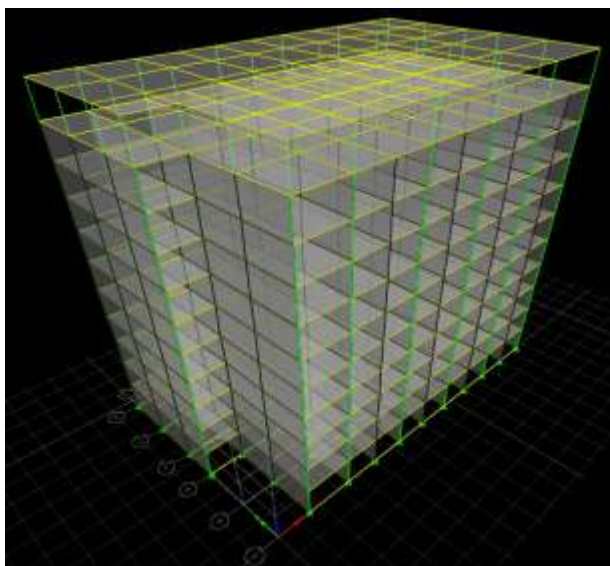


Figure No. 2. 3D view of 10 storey building model.

2.1. Construction Sequence Analysis

Sequential construction is very important analysis for high rise buildings where creep and shrinkage must be considered. In this analysis the analysis of each storey should be done considering all horizontal and vertical loadings in step wise manner. Sequential construction in ETABS 2016 version 9.7.4 allow to easily define a sequence of stages wherein selectively apply load can be applied on the portion of the structure and the sequence of stages can be matched on how the building will be construct and certifies more accurate result due to the considerations of non-linear behavior of materials.

3. Analytical Results

The parameters such as moment, displacement, shear, force displacement curve etc. have been study under earthquake load, wind load, gravity load, dead load and live load, with construction sequential analysis.

3.1 Displacement Result-

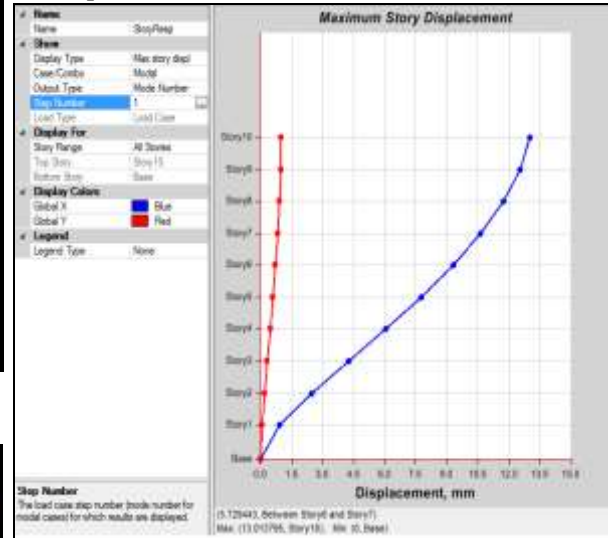


Figure No. 3 Maximum displacement from conventional analysis.

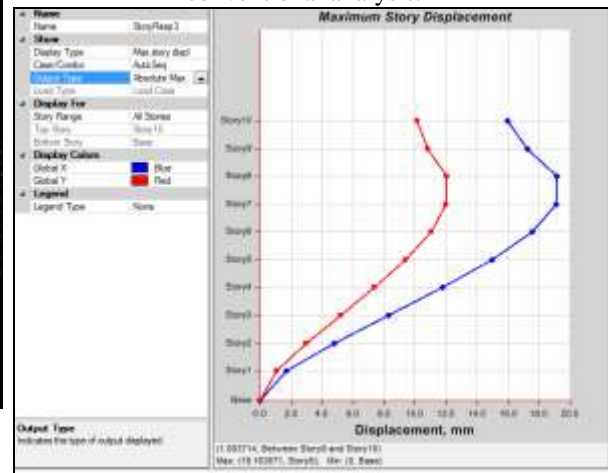


Figure No. 4 Maximum displacement from construction sequence analysis case.

3.2 Storey drift Result-

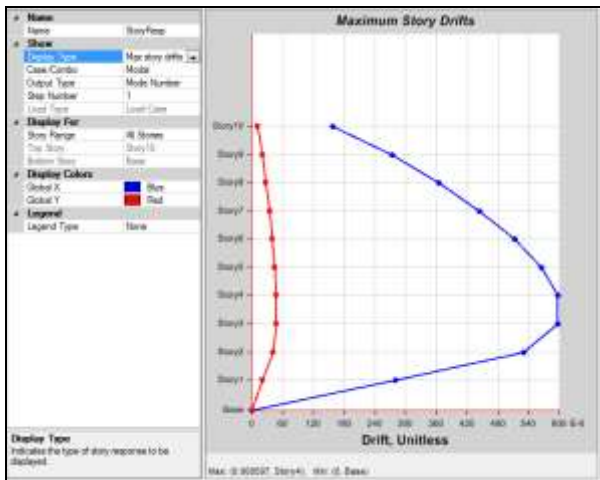


Figure No. 5 Maximum storey drift from conventional analysis.

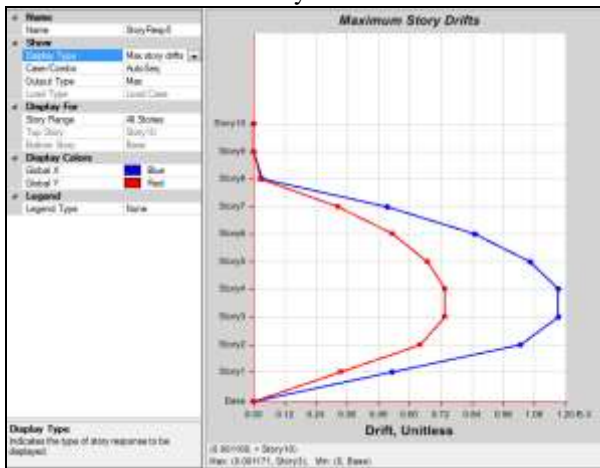


Figure No. 6 Maximum storey drift from construction sequence analysis case.

3.3 Shear Result-

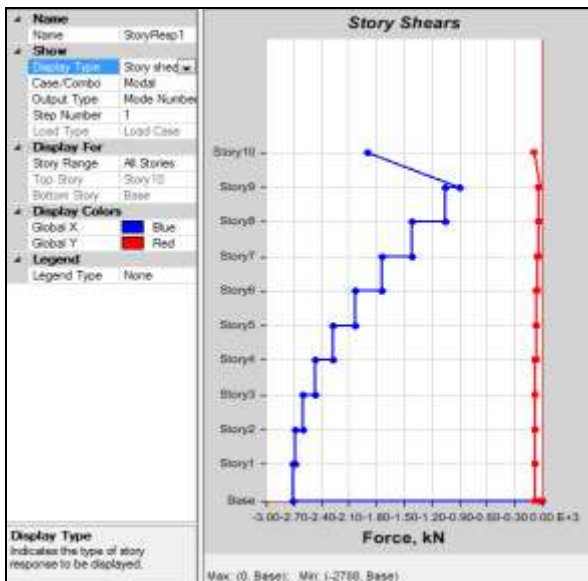


Figure No. 7 Maximum storey shear from conventional analysis.

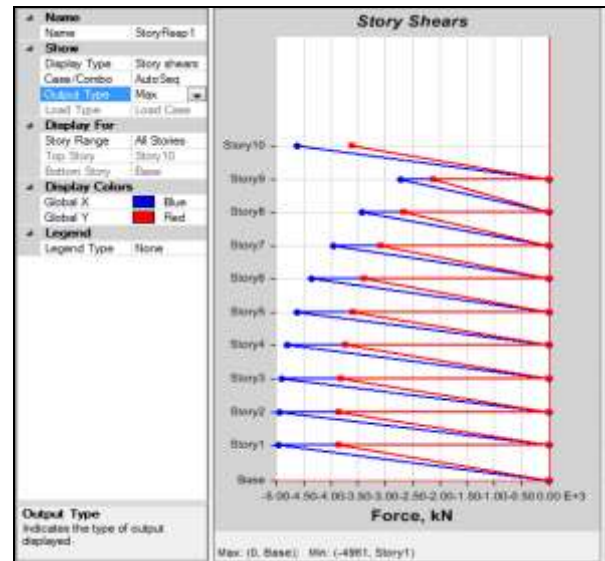


Figure No. 8 Maximum storey shear from construction sequence analysis case.

3.1 Force displacement curve from pushover analysis-

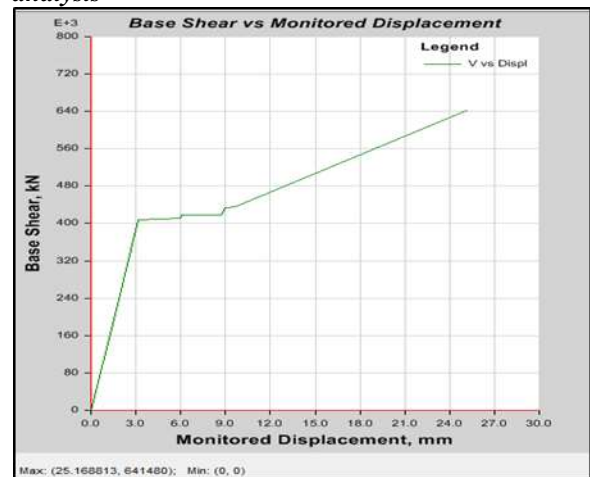


Figure No. 9 Force displacement curve.

4. Conclusion

In conventional analysis load is applied after completion modeling in one stroke but in reality the dead load is act sequential in nature so from this conventional analysis is not providing the actual result of behavior of structure. In actual case any building or any structure will be constructed sequentially so that load acting on various stages will be differ. So from the above result it is found that the construction sequence analysis is necessary to perform for overall structure to improve analytical results in terms of storey drift, displacement, base shear etc.

REFERENCES

[1] Ahmad Abdaelrazaq, Kyung Jun Kim ,Jae Ho Kim , "Brief On The Construction Planning Of The Burj

- [2] Dubai Project, Dubai, UAE," CTBUH 8th World Congress, Dubai, March 3-5 , 2008.
- [3] Chang-Koon Choi ,M. ASCE, E-Doo Kim, "Multistory Building Frames Under Sequential Gravity Loads",
- [4] Chang Koon Chai, Hey Kyo Chung, Dong Guen Lee. E.L.Wilson, "Simplified Building Analysis With Sequential Dead Loads-CFM", Journal Of Structural Engineering, Vol. 118, No. 4, April 1992.
- [5] IS 1893:2002, "Criteria For Earthquake Resistant Design Of Structures - Part 1", BIS, New Delhi, 2002.
- [6] IS 456:2000, "Plain And Reinforced Concrete - Code Of Practice", Bis, New Delhi, 2000.
- [7] IS 875 (Part 3)-1987, "Code Of Practice For Design Loads (Other Than Earthquake) For Buildings And Structures , Wind Loads" , B I S , N e w D e l h i , 1 9 8 9 .
- [8] Journal Of Structural Engineering, Vol. III, No. 11, Nov 1985.
- [9] K M Pathan, Sayyad Wajed Ali, Hanzala T Khan, M S Mirza, Mohd Waseem, Shaikh Zubair, "Construction Stage Analysis Of Rcc Frames". International Journal Of Engineering And Technology Research, Volume-2, Issue-3, May-June, 2014,Pp.54-58.
- [10] M. Hassanien Serror And A. Essam El-Din, "Assessment Of Internal Forces Induced Due To Differential Shortening Of Vertical Elements In Typical Medium- To High-Rise Buildings," Journal Of American Science 2012.
- [11] O.A. Rosenboom, T.F. Paret And G.R. Searer (2012), "Chronological Construction Sequence, Creep, Shrinkage And Pushover Analysis Of An Iconic 1960s Reinforced Concrete Building" , 15 WCEE Lisboa 2012.
- [12] S.C.Chakrabarti, G.C Nayak, S.C. Agarwala, "Effect Of Sequence Of Constructionin The Analysis Of Multistoried Building Frame", Building And Environment, Vol. 13, Pp.1-6.
- [13] Yousuf Dinar, Munshi Md. Rasel, Muhammad Junaid Absar Chowdhury, Md.Abu Ashraf, "Chronological Construction Sequence Effects On Reinforced Concrete And Steel Buildings", The International Journal Of Engineering.