

ISSN 2063-5346



# EFFECTS OF SEQUENTIAL CONSTRUCTION ON BUILDINGS AND SURROUNDINGS

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Article History: Received: 01.02.2023

Revised: 07.03.2023

Accepted: 10.04.2023

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## Abstract

As we know that the buildings known as RC buildings [2] or structures are designed one by one in a stepwise manner. But in today's era engineers are not taking it seriously about the effects around the buildings and surroundings, their loads and environmental effects while designing of any buildings. In our research paper we have discussed about effects of sequential construction on buildings and surroundings by using the fore around the axial part of the column. The load which is applied sequentially [1] is one of the most part of effects of construction on buildings. The one method which is widely used and effective is to use step by step method for construction as this will also reduce the one-time load over the buildings. We cannot avoid the effects of sequential construction while designing any buildings. We should also consider the effects of natural disaster as like earthquake.

**Keywords-** effect of sequential construction, creep, shrinkage, load towards axial.

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DOI:10.31838/ecb/2023.12.s1-B.216

## I. INTRODUCTION

In Today's era designing or construction of any building is a very challenging task to perform. One of the best structures is steel structure buildings for a very high designing [1] and high structure rise. This is useful because of the property of steel which is strength and ductility. But there are also some disadvantages for using steel as it is very costly and not easily available. That's the reason we have taken RC will be considered to construction of buildings. In olden days the structure of building will be designed with the use of single layer or step and the complete load will be applied at once for a given point. Now a days we have adopted a new technology of step-by-step process and in this load will be applied one by one so that it will not affect the environment [5] as well as human beings. There are also some factors that will be dependent on time like shrinkage and creep which will add the extra force, so those forces will be avoided in linear analysis.

The sequential construction [3] of buildings is also called stepping construction, this is because of the nature of step-by-step construction process loading. As soon as the frame is designed and analyzed properly the structure loads are applied. This is one of the most important factors in designing of the buildings this will help to apply the loads at a particular interval of time instead of applied load as once. In our research paper we have discussed about the sequential construction of buildings with different heights to analyze their effects for buildings and surroundings.



**Fig 1. Step-by-step construction of buildings.**

## II. CONFIGURATION OF THE STRUCTURED BUILDINGS

In this research paper we have discussed about the four to five building to see the effects of sequential construction on buildings step-by-step [4]. These buildings are having same plan, but some properties are different based on their vertical configuration. Below are the buildings name that we have considered.

- G+10
- G+20
- G+30
- G+40
- G+50

The total dimensions of the building that we have planned will be 30m x 12m. You can more relate with the help of diagram like in fig2. we have shown the structural plan while in fig2. We have tried to show the structural elevations of the buildings.

The model of the structure is ETABS 16[6]. The model that we have taken are having a height of 1.5m. For every sequential building construction, we have defined two models that are analyzed which will do the following.

Analyzing the sequential constructions

Avoiding the effect of sequential construction on buildings and surroundings.

Sequential construction is done for the load that is dead in nature. After this we will do the step-by-step analyzing of buildings.

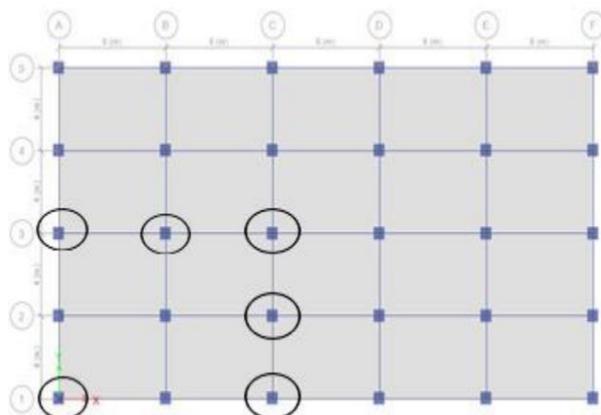


Fig 2. Structural plan of buildings.

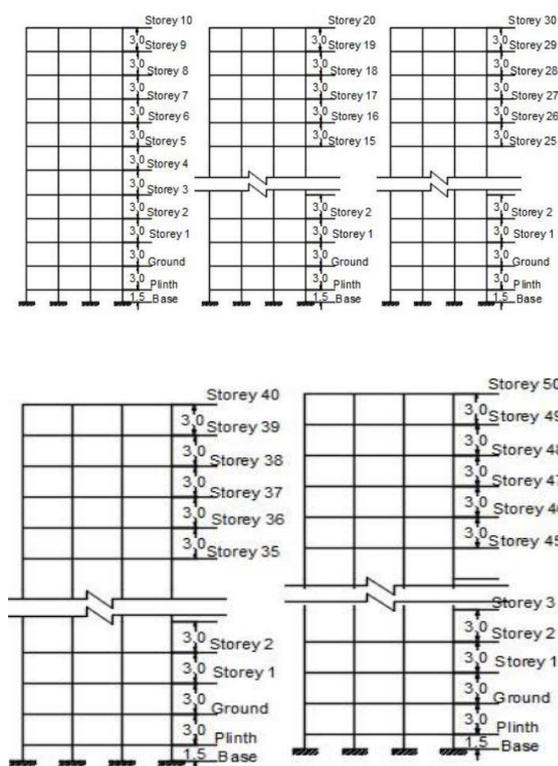


Fig 3. Structural elevation of buildings.

Table 1: Structural properties

Grade of Concrete	M30
Grade of Steel	HYSD 500
Beam dimensions	300x600
Column dimensions	600x600
Storey height	3m
Plinth height	1.5m

### III. OBSERVATION ON SEQUENTIAL CONSTRUCTION

As we discussed above, we are going to observe the five buildings from which we will be getting the internal action ratio of column. The changes in the position of the force applied on axial [7] will be 'Ratio alpha' for all the step-by step structures. We are having the x-axis with value of 0 which will determine the load on axial plinth for level 1 and this will continuously be increasing with storeys [8] from ground. We have analyzed the building with the help of ETABS with the given five buildings and their effects on the building's axial is define or shown in the graph.

$$R \alpha = \frac{I_i A_c C_s}{I_i a_w h o c C C s u}$$

#### A. Change in effects of number of storeys on Ratio alpha

We have plotted the graph based on the height of buildings columns[9]. On the basic of the position of buildings columns with storey were identified to use in the building.

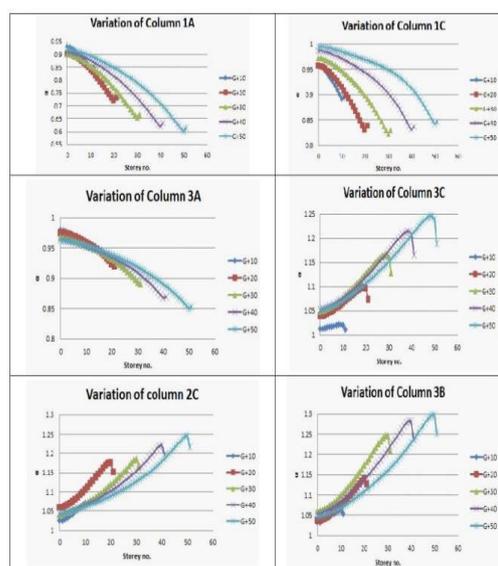
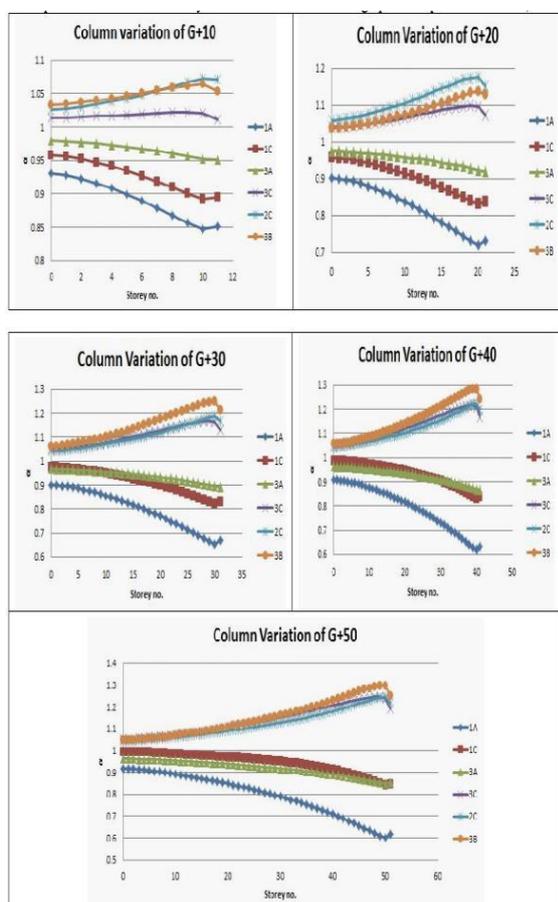


Fig 4. Ratio alpha effect on storey

We have observed from the graph that as soon as the height of the structure is going to increase so column variation [10] is also increasing continuously, i.e., both are directly proportional to each other. At the storey which is at lower will have less effect and it goes increasing with heights of the buildings.

## B. Change in effect of position of column on Ratio alpha

We have observed the effect in change of the position column, and we have plotted the graph below.



**Fig 5. Effect of position column on Ratio alpha**

From the above graph we have observed that as soon as there is any change in the ratio alpha variations the location of the column will also change. The column which are put on external will applied a more load on axial of the column while analyzing the sequential construction of

buildings. It seems to be observed that ratio [11] is less than 1 or 2.

While the column which are placed internally will try and applies more load, but ratio is more than 1 or 2.

## C. Internal Action beam ratio

We have observed that ratio of internal action of beam across the five buildings that we have taken into consideration. We see the bending moments of the beam across 3 sections in the buildings.

- Left bending.
- Right bending.
- Midspan bending.

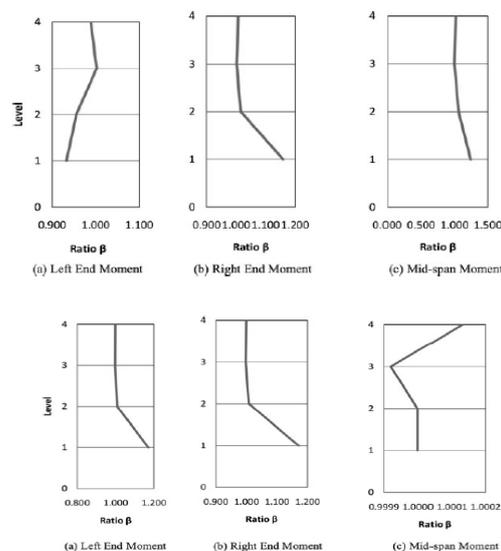
We have also obtained the reinforcement design column ration.

$$\text{Ratio } \beta = \frac{\text{Internal Action considering CSA}}{\text{Internal Action without considering CSA}}$$

We have concluded the following points for internal action beam ratio

Ratio beta[12] changes are seen at the maximum point when it is at the lowest storey and as soon as the level of storey will tends to increase the CSA will reduce.

There is a moment of internal beam, and its percentage goes increasing due to CSA and the maximum percentage is of 100 for left, 50 for right and 50 for midspan.



**Fig 6. Internal action beam plotted graph.**

#### IV. CONCLUSION

We have discussed and observed the effects of sequential construction on buildings and surroundings with the help of step-by-step modelling technique for five buildings. We have seen that there is a lot of changes at the top of the storey while minimum in the bottom, but its effect is constant as height of the building is increasing.

Sequential construction known as step-by-step construction will be designed or analyzed only for the internal designing purpose. The column positions in the building will also put some effects as column which is near towards the center will have high effect and this will reduce when we move further from the center of the buildings. This is one of the most important factors in designing of the buildings this will help to apply the loads at a particular interval of time instead of applied load as once.

#### REFERENCES

- [1] B SRI Harsha, J Vikranth 2014, "Study and comparison of construction sequence analysis with regular analysis by using etabs", International Journal of Research Sciences and Advanced Engineering [IJRSAE] Volume 2 , Issue 8, PP: 218 - 227 , OCT - DEC 2014
- [2] Snehal D. Poojara, Dr.Paresh V. Patel 2014, "Axial deformation of columns in multi-story R.C.buildings" International journal of civil engineering and technology (ijciet) Volume 5, Issue 3, March (2014), pp. 294-300.
- [3] K M Pathan, SayyadWajedAli, Hanzala T Khan, M S Mirza, MohdWaseem, ShaikhZubair 2014, "Construction Stage Analysis of RCC Frames", International Journal of Engineering & Technology Research Volume-2, Issue-3, May-June 2014, pp. 54-58
- [4] Tabassum G Shirhatti, Dr. S. B. Vanakudre 2015, "The effects of p-delta and construction sequential analysis of rcc and steel building with respect to linear static analysis" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 02 Issue: 04 | July-2015.
- [5] R. Pranay, I. YaminiSreevalli, Er. Thota. Suneel Kumar, "Study and Comparison of Construction Sequence Analysis with Conventional Lumped Analysis Using Etabs"
- [6] Shrikar S. Nayak, Ratnesh Kumar, and Ranjan S. Sonparote, "Effect of staged construction analysis on seismic design and performance of RC buildings".
- [7] Viji R Kumar, Binol Varghese 2017, "Effect of construction sequence analysis along with p-delta and material nonlinearity on floating column structure" International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 05 | May -2017
- [8] O.A. Rosenboom, T.F. Paret and G.R. Searer, " Chronological Construction sequence and pushover analysis of an Iconic 1960's reinforced concrete building"
- [9] Sagupta R. Amin, S.K. Mahajan, "Analysis of multi storied RCC building for construction sequence loading" International Journal of Modern Trends in Engineering and Research
- [10] Chakrabarti, S.C., Nayak, G.C., and Agarwal, S.K. (1978). "Effect of Sequence of Construction in the Analysis of Multi-storeyed Building Frame," Build Environ., 13, 1-6. 2.
- [11] ETABS 9.6 (2010). Structural analysis software, "Extended 3D Analysis of Building Systems", Computers and Structures, Inc., Berkeley,
- [12] USA. 3. IS 456. (2000). "Plain and Reinforced Concrete – Code of Practice (Fourth Revision)," BIS, New Delhi, India.