International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 13 Issue 5, May-2024, Impact Factor: 8.375

A look at Construction Sequence, Creep, Shrinkage Analysis of High-Rise Concrete Building

Garvit Chaudhary[1], Dr. Rambha Thakur[2]

[1]Research Scholar, Rattan Institute of Technology and Management, Palwal, India
[2]Assistant Professor, Rattan Institute of Technology and Management, Palwal, India

ABSTRACT

In traditional analysis where we create a model of the structure and then applied the load and then do the analysis and what we found that for shorter buildings the traditional analysis is adequate and certainly acceptable. In most cases the traditional analysis is certainly valid for live load cases because that the way the live load actually applied to the structure. But the dead load the acts on a building is in a real life is a sequential load. We have our live load, wind load, and seismic load these loads generally we consider to act on complete structure. The dead load however depends on the construction sequence. So, at any particular time t whatever part of the building model complete the dead load will act upon that part and because of this the response of the structure to the dead load may be different from others which we normally get if we consider the construction sequential analysis. In this paper a high- rise RC frame has been taken and considering the effects of creep, shrinkage and Geometric non-linearity have been analysed and results such as bending moment, shear force, axial force, deflection of beam and column has been compared with traditional analysis of high-rise building and plotted graph for particular column and beam.

Keywords: High rise building, construction sequential analysis (CSA), Linear dynamic analysis (LDA), creep, shrinkage, Geometric non-linearity in ETABS.

INTRODUCTION

In traditional analysis typically in first step we use software and create model. we define geometry specify storey height specify bay spacing and member properties and we create model of our entire structures. Then in next step we specify loads such as self-weight, dead load, imposed load and lateral loads and place on the structure and we analyse thestructure and we get the design forces and we use those forces in our design.

The questions are how realistic is this. Is this really the way a real building is loaded in all places and then it deflects? Live load – typically all the building constructed on place then the people start living over there and building get deflects. So, for live load that traditional analysis is correct. The building is in place physically completed and then the live load components are acting to the structure. So that traditional approach for analysis of live load is certainly appreciated in problems.

Dead load- In a construction of building we build the leading floor and then we remove the shoring and immediately the loads on that single floor are applied and the structure displaces. And then again, we build next floor level on that structure and after that we remove the shoring and that storey displaces. The impacts, the load of that storey is also loading on the storey below and so, the frame is built storey wise and immediately loaded with self- weight. When we talk about self-weight the majority of dead load is due to self- weight of concrete in RC frame building. And so, we build all the level and the load immediately takes effects and induces those forces into the member until we find the roof. But that is fully different than the way looks the live load and that's entirely different the way we analysis the structure.

For the dead load, it's not the case where the entire structure is in place and then retain the gravity load and suddenly, we get all these displacements. But it's actually applied step by step or stage by stage and so, we call it sequential analysis. An analysis is taken into account that need to be consider. In short storey building probably there is no as such problem like column shortening occurs. But in super tall buildings column shortening due to the effects of creep, shrinkage, andtemperature variation occur.

LITERATURE REVIEW

Study on Literature

Choi et al. (1984) analysed and concluded the projected multi-storey frame analysis technique during this study is easy to implement and really effective to deal with the issues of the differential column shortening during a building thanks to its gravity masses. This technique has been applied to 2 building frame analysis issues, i.e., a 60- story steel building frame and a 10-story RC building. The results obtained during this study have shown that the differential column shortening and also the bending moments elicited by it within the gravity analysis of entire frame are terribly vital and may not be neglected in the analysis of the high-rise buildings. Considering the improved reality obtained by the strategy projectedduring this study, some extra procedure efforts needed will be justify.

Dubay et al. (2017) Analysed and concluded High-rise buildings are being created everyplace in gift world. the scale like height of high-rise buildings are becoming larger and bigger day by day. it's been detected that structural style of high-rise buildings is incredibly a lot of addicted to dynamic analysis for winds and earthquakes.

Since, in gift state of affairs use of laptop has progressed remarkably, the majority structural sty leers use software system for the analysis and structural design of high-rise buildings. Hence, afterward the determination of structural arrange and description of high-rise buildings, the structural style of individual structural members has been done by exploitation varied structural software system. This analysis procedure by structural software system makes it additional necessary that the structure model becomes more realistic and field familiarised in nature.

Assumptions are remodelled the past few decades that the multi-storied frames have been analysed, taken into thought that each one the masses returning over the structure to be created particularly dead weight of structure that's self-weight, the load because of objects gift in structure that's load on the finished frame at the identical time instant that's conclusion when completion of structure.

However, in the development of the frame takes place structure by storey that's stage by stage that is in a serial order and masses are applied consequently on a shut in a sequential manner. The variation discovered within the performance of the framed structure is because of undeniable fact that the distinction between theoretical and actual construction observe manner. so as to research the structure for the planning section the structural analysis should be done in line with the particular construction observe that's staged analysis fashion and thus construction sequence analysis is employed. We are observant or noticing in current scene of construction that the peak of structures is increasing drastically, however the challenge lies within the stability of structure.

The force that are exerted upon high rise buildings are forces like unstable force, wind forces etc., and leave their impact. all-fired self- heaviness or weight may be an issue of uncertainty and conjointly a controversy which can result in failure of frame if the stresses of forces cross the tolerable limit, thus over safe frame is intended to beat these limitations. We are trying to cheap, reasonable and economic solutions of building construction that cannot be carry through if over safe styleis taken into consideration and it should conjointly result in high value of structure.

In consequence of that analysis that is error free is obligatory or we are able to say a requirement normal of judgment for multi-storey frame to attain stability, safety and economy. Work recommended seeks to search out additional realistic and correct thanks to analyse a structure to attain the desired parameters in realistic, economical and safety of frame.

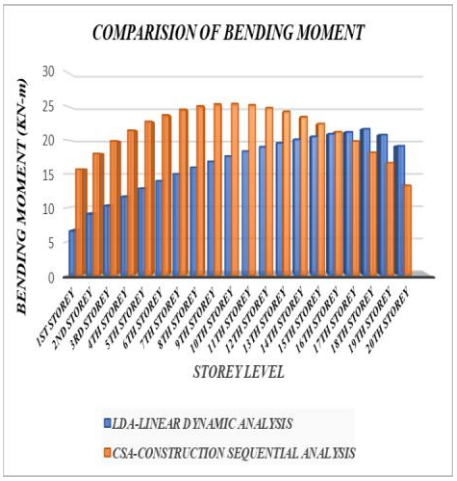
METHOD

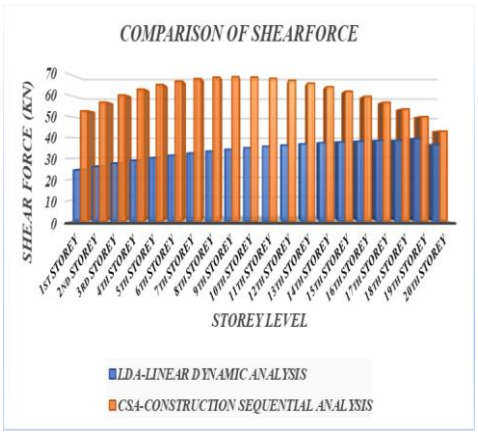
There are several important steps are involved in CSA usually which is not include in linear dynamic analysis. To generate the consequences of stage construction analysis of individual level is complete with the next level in a such a way that the lateral load as well as vertical load apply from the plinth level of whole structure to the proceeding floor. Conclusively the results will show the response of the structure up to the proceeding floor. To get the construction stage effects whole storey should be analysed in a similar way. This method works in a such a way that once the whole load applied to the structure is completed each and every particular step grouped and the software is allowed to analyse that storey with the succeeding storey and the software ignore the effects of preceding storey. After the final grouping of storeys, thesoftware gives the results which we can compare at each storey with the linear dynamic outcomes.

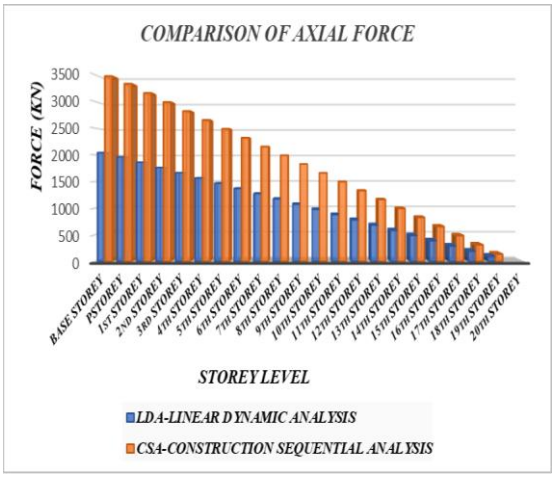
The method of analysis to solve such a complex problem depends upon the nature of the output needed, extent of loading etc. In most of the structures, the design loads generate stresses which are normally within the elastic range. When large field problems are handled, non-linear analysis may need lot of approximations and this may dilute the regards of the analysis. Also, the object is not to study the failure pattern but behaviour of raft at ultimate limit states. Therefore, linear elastic analysis has been resorted to for the present study, since the loading that is considered is well within the elastic limits.

FINDINGS

The study on sequential construction analysis and linear dynamic analysis has been conducted. In this study there are 4 cases have been studied, which are analysis of G+20 building with shear wall and analysis of G+20 building with shear wall and floating column. The shear wall has provided at different location such as at corner, corner and core of the building, periphery of the building, periphery and core of the building. In this analysis material linearity and non-linearity has appliedto the structure.







CONCLUSION

An analytical model to reproduced the material nonlinearity behaviour of a RC structure considering the step by step construction is proposed in this paper, the proficiency of the presented paper is checked by the comparison with results from the linear dynamic analysis and construction sequence analysis. Also, based on the previous analytical and experimental analysis. Based on the numerical outcomes in this research the following ends are acquired. (1) Larger bending moment, shear force and deflections are obtained when the stage construction analysis with and without

considering material non linearity effects in concrete are considers. (2) large serviceability issues in the non-structural members situated among interior and exterior columns are incited by the differential column shortening, while the BM in beams due to column shortening are critical.

The proposed multi-storey model test procedure in this investigation is easy to execute and viable to adapt to the issues of the differential section shortening in a structure because of its gravity loads. The results gotten in this research have demonstrated the differential section shortening and the bending moment initiated by it in the gravity analysis of whole model are exceptionally noteworthy and ought not be disregarded in the examination of the elevated structures. Thinking about the improved reality acquired by the strategy proposed in this research, some extra computational endeavours required can be validate.

Construction stage analysis of tall structures and super tall structures are necessary to improve the design results accuracy in terms of bending moment, shear force, axial force and deflection in supporting beam and column near of it and also for overall structures. The displacement in the construction stage analysis is more in supporting beam at storey 1 and it is going to be decrease as storey level increase as compared to linear dynamic analysis i.e. traditional analysis where deflection in supporting beam less at bottom andmore at top.

The shear force in the construction stage analysis is high as compared to traditional analysis. Hence, for tall and super tall building construction stage analysis with andwithout time dependent effects shouldbe considered for design.

The bending moment in the construction stage analysis for both structures with and without floating is more as compared to traditional analysis. Hence construction stage analysis should be considered foraccurate design results.

REFERENCES

[1] AISC (American Institute of Steel Construction). (2010). "Seismic Provisions for Structural Steel Buildings." *AISC41-06*, Chicago, Illinois.
[2] FEMA (Federal Emergency Management Agency). (2000). "Prestandards and Commentary for the Seismic rehabilitation of buildings," *FEMA 274*,Washington, DC.
[3] Kwak, H.G., and Kim, J.K. (2005). "Time-Dependent Analysis of RC Frame Structure Considering Sequence" *Building and Environment*,2, 200-210.
[4] Njomo, W., and Giray, O. (2014)." Sequential Analysis Coupled with OptimizedSubstructure Technique Modelled On 3D-Frame Construction Process"*Engineering Structure*, 1, 200- 210.
[5] Kim, H. S. (2016). "Column Shortening Analysis with Lumped Construction Sequence" *Procedia Engineering*, 4, 1791- 1798.
[6] Madutujuh, M. (2016). "Simplified Method for Sequential Load Analysis of Tall Building with Transfer Girder and Diagonal Bracing" *International Journal of Civil Engineering*, 2, 120-138.
[7] Baznat, Z.P. (2001) "Series Creep Function for Aging Concrete". *Journal of Engineering Mechanics*, 2,112-128.
[8] Choi, C.K., and Kim, E.D. (1997). "Multi-Storey Frames Under Sequential Gravity Loads". Journal *Structural Engineering*, 1, 48-59.
[9] Kwak, H.G., and Kim, J.K. (2006). "Time-DependentAnalysis of RC Frame Structures Considering Construction Sequence".*Building and Environment*, 3, 400-414.
[10] Sharma, R.K., and Nagpal, A.K. (2007). "A Procedure for Creep and Shrinkage Analysis of Frames with Low Beams Stiffness". *The StructuralDesign of Tall and Special Buildings*, 17, 739-755.
[11] Mohammad, A.R. (2015)."Construction Sequence Analysis of Building with Vertical Discontinuity". *Global Journal of Engineering Scienceof Research*, 2, 117-130.
[12] Placement and Location of ShearWall https://www.quora.com/What- are-shear-walls, Referred on 21/03/2019.
[13] What is Response reductionfactor.https: //www.thestructuralmadness. com/ 2018/08/what-is-response-reduction-factor. html Referredon 26/03/2019.
[14] Transfer Girder https://www.quora.com/What-is- the-design-and-construction-difference-between-a-transfer-beam-and-an-ordanary-beam Referred on 21/03/2019.
[15] What is Linear Static Analysishttp://www.iaa- conservation.org.il/pdf/ engineers2011 /09_ Types%20of%20analysis.pdf Referred on 28/03/2019.
[16] High Rise Building Design with Construction Stage Analysis https://www.youtube.com/watch?v=APRKi6Rc9Vg&t=1894s Referred on 21/03/2019.