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COMPARISON OF LINEAR STATIC AND DYNAMIC ANALYSIS OF MULTI-STOREYED BUILDING WITH PLAN IRREGULARITIES

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Abstract- *Analysis and design of buildings for static forces is a routine affair these days because of availability of affordable computers and specialized programs which can be used for the analysis. On the other hand, dynamic analysis is a time consuming process and requires additional input related to mass of the structure and understanding of structural dynamics for interpret action of analytical results. In the present study a multi-storied framed structure of (G+10) pattern is selected. Linear seismic analysis is done for the building by Static (Seismic Coefficient) method and dynamic (Response Spectrum and Time history) method using STAAD-Pro as per the IS-1893-2016-Part-1. A comparison is done between the static and dynamic analysis, the results such as Bending moment, Nodal Displacements, Axial forces are observed, compared and summarized for Beams, Columns and Structure as a whole during both the* analysis.

Keywords: Reinforced Concrete, seismic analysis, Response Spectrum Method, Time history Method

INTRODUCTION

Structural analysis is especially involved with sorting out the behavior of a structure once subjected to some action. This action are often within the kind of load thanks to weight of things like folks, furniture, wind snow etc. or another quite excitation like earthquake, shaking of the bottom thanks to a blast close, etc. In essence all these loads are dynamic including the self- weight of the structure because at some point in time these loads were not there. The excellence is formed between the dynamic and static analysis on the premise of whether or not the applied action has enough acceleration as compared to the structure's natural frequency. If a load is applied sufficiently slowly, the inertia forces (Newton's second law of motion) are often unheeded and also the analysis is often simplified as static analysis. Structural dynamics, therefore, may be a form of structural analysis that covers the behaviour of structures subjected to dynamic (actions having high acceleration) loading. Dynamic masses embody folks, wind, waves, traffic, earthquake, and blasts. Any structure is often subjected to dynamic loading. Dynamic analysis is often wont to realize dynamic displacements, time history, and modal analysis.

LITERATURE REVIEW

Seismic Analysis of RCC high-rise building is relatively analyzed by equivalent static methodology and dynamic analysis by linear and non-linear methodology (response spectrum and time history method). Ton of analysis has been allotted by varied researches on Static and dynamic analysis however during this work comparative study of three methodologies is finished.

Summary of Literature Review

Within the literature review it had been found that each one the researchers have compared the structural style outputs of the unstable style by static or dynamic ways. A Comparative study may be created to check the results obtained by doing unstable

analysis by static methodology, response spectrum and time history methodology. An endeavor might even be created to check the values obtained from totally different software's. Another comparison that perhaps done is that comparison of a web site that is analyze by static and dynamic and once optimizing each models check it's economy. It's seen that each one the literature offered has worked upon the consequences of unstable forces solely engaged on the building. Constant buildings might are compared for the wind forces engaged on the structure together with the unstable forces. Also, a composite building manufactured from RCC and Steel may be compared.

OBJECTIVES

1. To study the effect of static and dynamic parameters of RCC frame structure.
2. To determine and compare moments, axial forces, torsion for vertical and horizontal members.
3. To determine nodal displacement of vertical members and deflection of horizontal members.

Scope of Work

1. The present study is concerning the Comparative study of static and dynamic (linear & non-linear) analysis of high-rise RCC irregular building and the results are compared moments, axial force, torsion and nodal displacements.

Problem Statement

In India, for high rise RCC irregular building seismic analysis is should to carried at the time of design of building however typically it's been troublesome to try to dynamic analysis but as per Indian code IS 1893-I for high rise building (>15m & having zone III, IV, V) dynamic analysis is needed. Thus during this study I'm progressing to check results of static and dynamic analysis with response spectrum and time history method.

METHODOLOGY

Structural modelling of super structure in Stadd-pro V8i

A G+10 storey residential building is analyzed using the commercially available software (Stadd-pro). The building is analyzed for static load as well as for dynamic load. The slabs, beams, columns of the building are design as per IS 456 2000.

Following parameters are considered while modelling of super structure:

No. of Storeys	G+10
Floor Height	3 m
Floor Finish	As per IS 875(I) : 1987
Live Load	As per IS 875(II) : 1987
Earthquake Load	As per IS-1893-2016
Seismic Zone	III (As per IS 1893)
Plan Size	24.00 x 28.29 m
Static Analysis	Equivalent Lateral force method
Dynamic Analysis	Response spectrum method

Type of Soil	Type-II, Medium soil as per IS-1893
Material used	Concrete M-30 and Reinforcement Fe-415

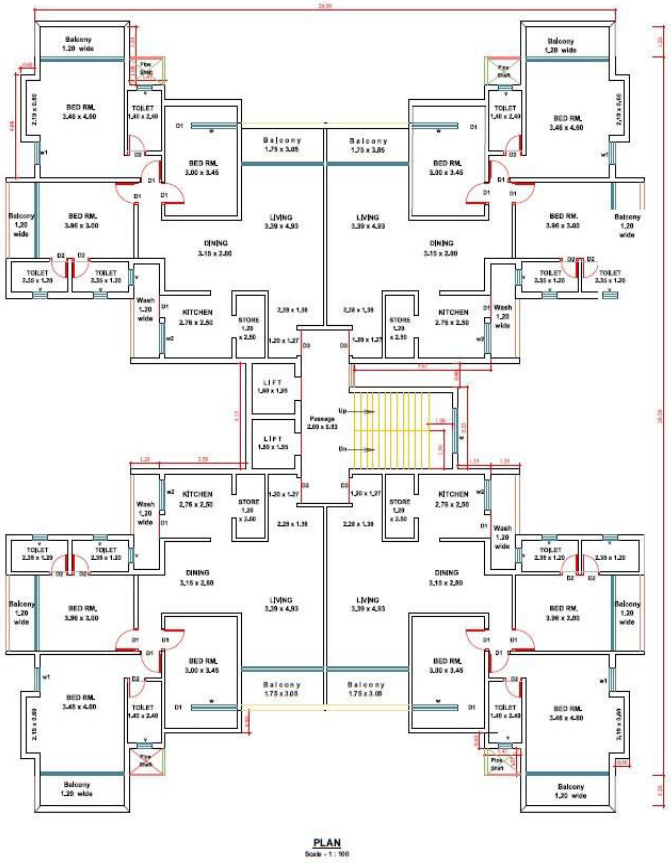


Fig 1: Layout of G+10 RCC Irregular building plan

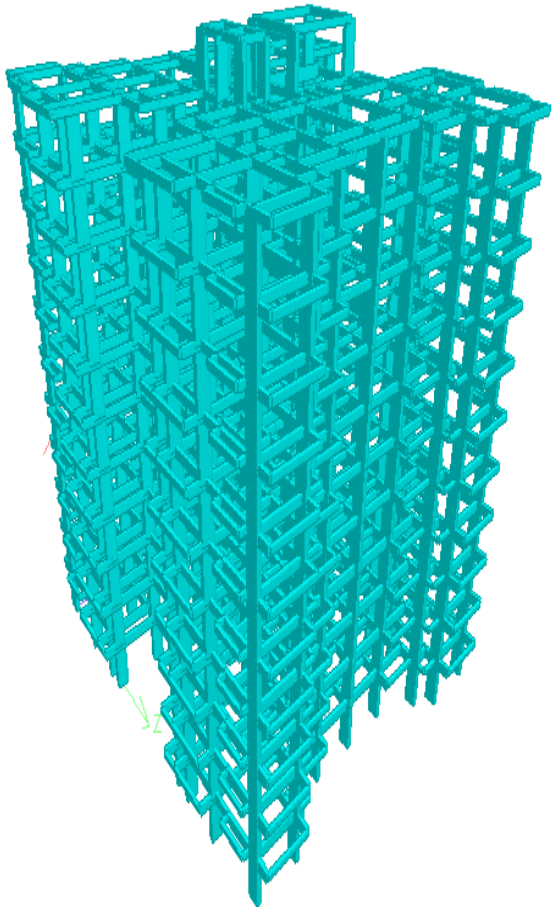


Fig 2: 3 D model of G+10 RCC Irregular building plan

RESULTS

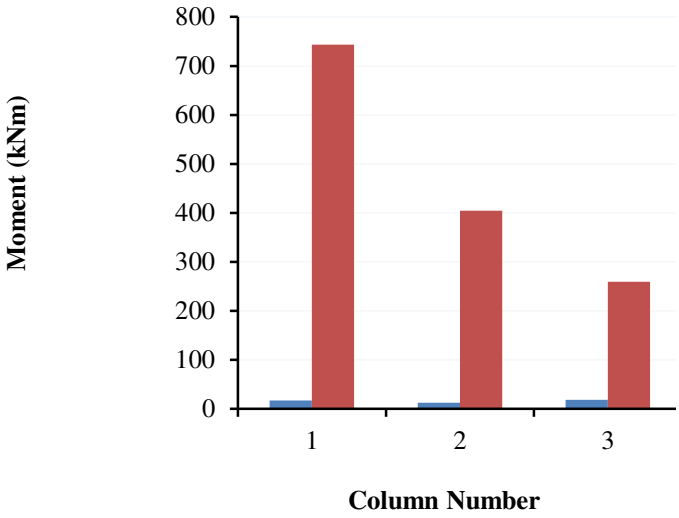


Fig 3: Comparison of Moment for Vertical Members

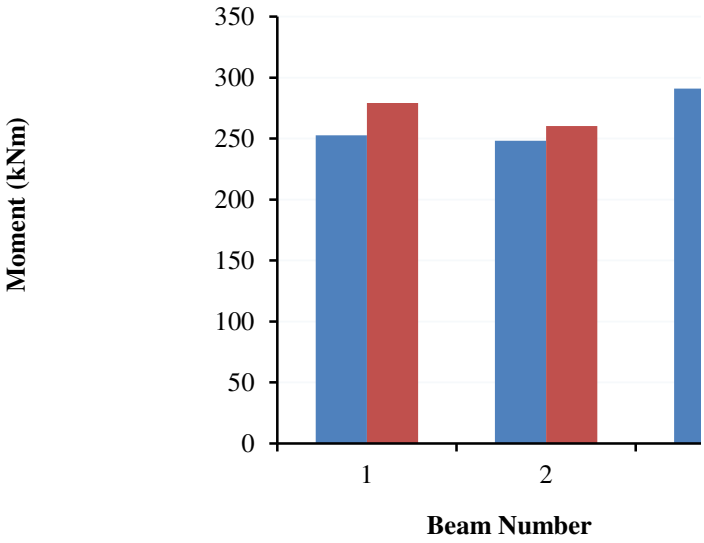


Fig 4: Comparison of Moment for Horizontal Members

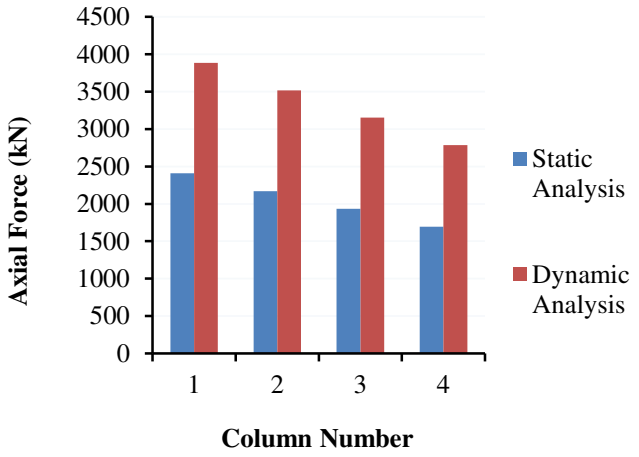


Fig 5: Comparison of Axial Forces for Vertical Members

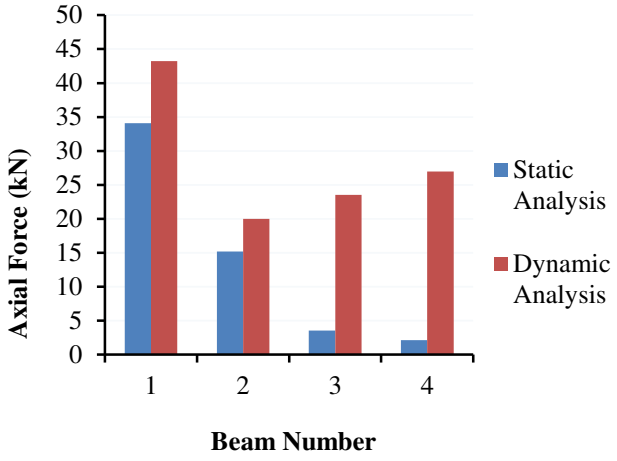


Fig 6: Comparison of Axial Forces for Horizontal Members

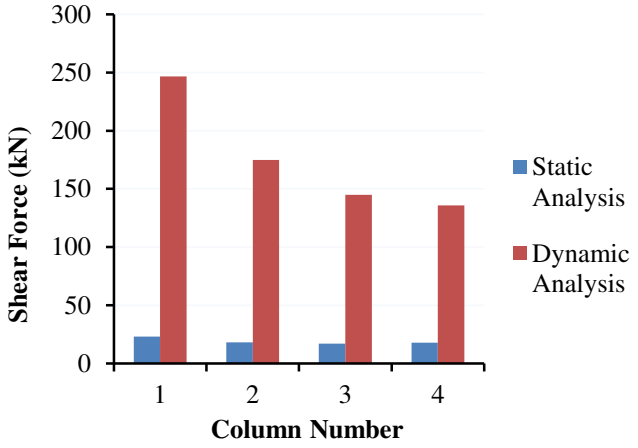


Fig 7: Comparison of Shear Force for Vertical Members

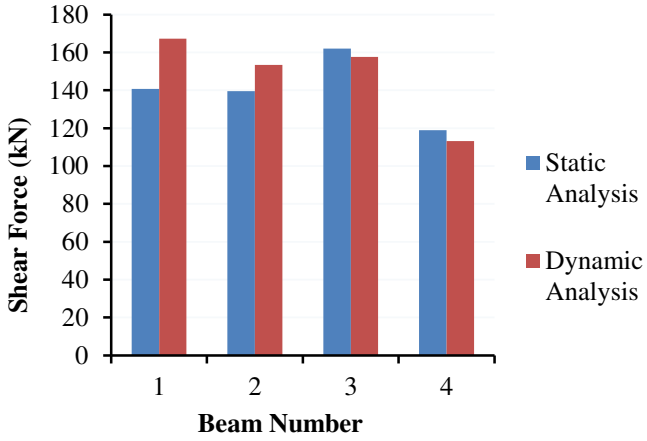
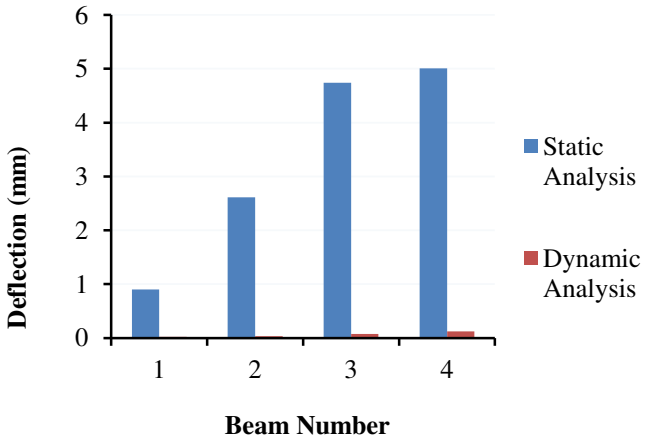


Fig 8: Comparison of Shear Force for Horizontal Members

Fig 9: Comparison of Deflection



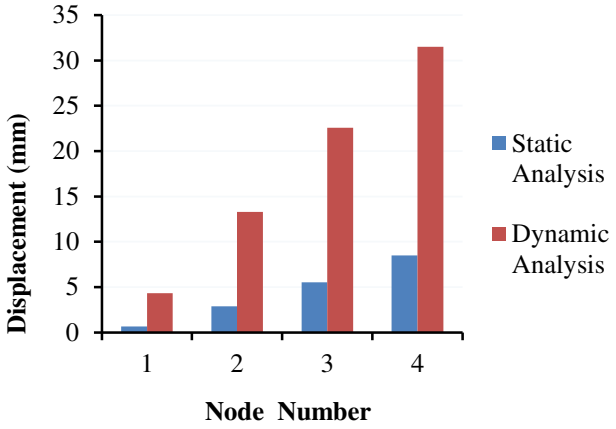


Fig 10: Comparison of Nodal displacement

Conclusion

1. The values of moments for dynamic analysis are 35 to 45 % surpassing static analysis in case of vertical members as seismic forces acted on joint only.
2. In case of beam, moment is analogously and compressive and tensile stresses were relatively equal.
3. There is scarcely disparity in the values of axial forces of static and dynamic analysis as attained for the RCC structure.
4. The values of torsion of columns are negative for static analysis and vice versa for dynamic analysis.
5. The values of deflection for static analysis are 40 to 45% surpassing dynamic analysis in case of vertical members.
6. Nodal displacements in beams and columns due to seismic excitation showed much larger values compared to that due to static loads. Nodal displacements in Z direction are 50% higher for dynamic analysis than the values obtained for static analysis.

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Design codes

1. IS 456 : 2000 (Code of practice for RCC detailing)
2. IS 875(I) : 1987 (Dead load)
3. IS 875(II) : 1987 (Live load)
4. IS 875(III) : 2015 (Wind load)
5. IS 1893(I) : 2016 (General design criteria for earthquake building)
6. SP 16 (For Beam Column Design)

List of publication

Comparison of Both Linear Static and Dynamic Analysis of Multistoreyed Building with Plan Irregularities: A Review, International Journal for Research & Development in Technology, Volume-14, Issue-5(Nov-20) ISSN (O):- 2349-3585

http://ijrdt.org/see_album_all_paper/9092/ISSUE-5-NOV-2020

or

http://ijrdt.org/full_paper/53018/1023/COMPARISON-OF-BOTH-LINEAR-STATIC-AND-DYNAMIC-ANALYSIS-OF-MULTI-STOREYED-BUILDING-WITH-PLAN-IRREGULARITIES-A-REVIEW