RESEARCH ARTICLE OPEN ACCESS

SEISMIC ANALYSIS OF RESIDENTIAL BUILDING (G+7) USING STAAD-PRO

Vikas C. Patle[1], Saurabh K. Jayswal[2], Vinayak S. Kuthe[3]
1(Department of Civil Engineering, RadhikataiPandavCollege of Engineering, Nagpur
2(Department of Civil Engineering, RadhikataiPandav College of Engineering, Nagpur
3 (Department of Civil Engineering, RadhikataiPandav College of Engineering, Nagpur

Abstract:

The main need of human of human is to provide the economic and efficient shelter. The permanent and temporary structure enclosed with in outer wall and ceiling, all attached equipment's and fixtures which cannot be remove without cutting the ceiling, floors, walls. To increasing the life of overall structure, seismic analysis is needed. Seismic analysis is the calculation of the response to a building structure for earthquake is a subset of structural analysis. In this paper we had comparing the structural model of building in four different zones i.e. for zone II, zone III, zone IV and zone V. After comparing all the models, the result obtained as 5 to 10 % variation in moment and axial force. All the design should be adopted according to IS 1893:2002, 456:2000.

Keyword: Building, seismic analysis, STAAD Pro, IS code.

INTRODUCTION

The basic needs of human life are food, clothing's& shelter. From times immemorial man has been making efforts in improve your living standards. The point of his effort has been to provide and economic and efficient shelter. The owner of sheltered settlements is giving a sense of origin, use, responsibility, security and shows the social status of human.

Permanent or temporary structure enclosed with in outer walls and ceiling, and all attached equipment, and fixtures which cannot be removed without cutting in the ceiling, floor and walls.

This is a method by which we find the safe and affordable specification of one member of sufficient structure to structure or load. Search in other words need of cross section dimension, grade of material, reinforcement etc. is required. We face internal structures that meet us with structural analysis. Seismic analysis is the calculation of the response to a building structure for earthquake is a subset of structural analysis.

A quick and easy way to set consolidation of overburden. The law is based on the principle that shock waves different speed and accompanying sound travel through different sub surface content different paths. By this method the operator can determine whether the burden can be broken or not whether it needs drill and expansion.

Structural design is the technical analysing and designing of any structure ultimate strength economy, safety and serviceability. It does not only requires imagination and conceptual thinking but also the chasten to maintain design standards specified by the IS codes.

Standard Design Codes

The design should be done to ensure:
1)Plain and reinforced cement concrete- IS 456: 2000 (IV revision)
2) National Building Code 2005
3) Loading Standard IS 875(Part 1-5):1987-codes of practice for design load and earthquake for building and structure (II revision)
• Part I: Dead loads

• Part II: Imposed (live) loads
• Part III: Special loads and load combinations
4) Design Handbooks
• SP 16: 1980 – Design aids (for Reinforced Concrete) to IS 456: 1978
• SP 34: 1987 – Handbooks On Concrete Reinforced And Detailing.

STAAD PRO

This is one of the effective software that is use for the purpose of analysis and structure design by structure engineers. The purpose of our project is to fulfil with the help of STAAD Pro.
STAAD Pro gives more accurate and accurate results than manual technique.
It includes a state of the arts user interfaces, visualization tools and international design codes.
It is used for 3D model generation, analysis and multi-material design.
Commercial STAAD Pro supports many steel, solid and wood design codes.

Advantages of staad.pro

1. The Flexible modelling environment.
2. In STAAD Pro, it gives wide range of design codes.
3. This software has been included in the design of building of structural engineering.
4. This software modified design use in open architecture.
5. It is very easy to use.
6. This software is use by maximum number of people in worldwide, where they are in design criteria.
7.This software provide accurate units of measurement.
8. In this software the greatest quality of structural design is assurance.

Features of STAAD Pro software

1) STAAD Pro Graphical User Interface:- It is used to theymake models, which can then be analyzed using the STAAD engineer. After completion of analysis and design, GUI can also be used to see result drawing.
2) STAAD Pro analysis and design engine:- This is a general purpose structural analysis and computing engineers for integrated Steel, Concrete, Timber and Aluminium design.

LITERATURE REVIEW

1) S. Ramanarayan, A .Manjunath, K V Rsatyasai, S. Lokeswari. "SEISMIC ANALYSIS AND DESIGN OF RESEDENTIAL BUILDING (G+4) USING STAAD PRO'', in this paper, they studied that, seismic analysis for earthquake design resistant structure. Current work works with the analysis of G+4 residential building in which dead loads and live loads apply and structural design dimensions for beams, columns have been obtained, beams and columns will be designed according to IS 456:2000 and IS 875 (part 1). There are several criteria in this program which have been prepared according to is 456:2000 be designed for beams, shears and twist.

2) Akshay R. Kohli, Prof. N.G. Gore, "Analysis and design of an earthquake resistance using STAAD Pro." In this paper, they study that, the main purpose of this letter is to make and earthquake resistant by the structure of the seismic study structure of the static equivalent method analyse and complete the analysis and design of building using STAAD. The structural safety of building is ensured by calculating all the acting load on it structure, which includes lateral load due to ventilated load and seismic stimulation, they the conclusion is that, as a result, inter-story dript should be obtained within the specified limit. For minimum specified lateral force with partial safety factor of 1.0, the inter-story drift should be under 0.04 x Hs, where (Hs) is the story height (Clause 7.11.1, IS 1893:2002 (part 1)). For 3300 mm floor height, inter-story drift = 0.04 x 3300 = 13.2 mm. The actual relative displacement between every story in the structure is below the inter-story drift limit and hence safe. It undergoes static as well as dynamic analysis of the structure and gives accurate results.

3) K Aparnashrivatav:- " seismic analysis and design of G+5 residential building." In this paper, the study that, the structure analyzed with various combination as per code IS 1893:2002(part I). (DL,LL,WL,EL) with 10 primary loads and 26 loads combination analyzed and theworst load combination is deducted and design moved to bad load combination using STAAD Pro. Creating the same structure without considering the lateral load to perform and show investigation of steel and solid quantity variation and structure for both structure downstream using STAAD Pro. They conclude that, (i) In earthquake resistant design the steel quantity increased by 1.517% to the conventional concrete design. The steel quantity increased in the structure ground floor level to higher floor level of the structure. (ii) In this study of G+5 building, seismic load dominates the wind load under the seismic zone III. Basically the wind pressures are high for high rise building based on weather condition such as coastal areas, hilly station. For building prominently seismic forces create the major cause of damage to the structure. (iii) The storey drift condition for considered G+5 building, the base drift =0.0 at every storey. This says that the structure is safe under the drift condition. Hence shear walls, Braced columns are not necessary to be provided. Hence storey drift condition is check for the G+5 building. (iv) The structure design for worst load combinations namely 25, 27, 24, 11 of 36 load combinations.

4) M.S. Alpha Sheath:-"use intermediate RC movement frames in moderate seismic zone". Indian concrete magazine, in this letter, the author argues that simplification of humility details in field III will encourage very detailed spread implementation.IS 13920:1993 removes the need for a specific special design and explanation reinforce concrete, moment resistant frame (SMRF) to give them enough crush and flexibility to cover without facing severe earthquake and emerging medium with same non-structural damage. The code suggest the same dummy description required for zone III, IV & V the area was very little shaking in III cities.to compensate for the reduction in cruelty due to exemption dummy norms, decrease in reaction factor the special RC moment should be less than the value of 5 for the resistive frame, but may be more than 3 for RC moment resistant frame. Same of the provisions have been explained for flexural members, pillars and structural walls etc. in this letter the author suggested that the conclusion is that, in the field II and III, the building may be less rigid flexibility can be designed with retail sales, but with the increase in seismic design force.

5)Anoop Singh, VikasSrivastava, N.N. Harry, "seismic analysis an design of building structures in STAAD Pro. In this paper, they study that seismic reaction of structures is examined earthquake stimulation was expressed in the form of joint displacement, member forces, story drift and support feedback. Reaction for G+10 building structure is examined design software using STAAD Pro. They see a decrease in the reaction of the case common moment resist frame. In this case we have taken earthquake area II, feedback factor 3. resisting the frame and importance factor 1 for the normal moment. This paper, main the conclusion is that, (i) design calculate by IS 1893:2002 according to calculation made by STAAD Pro. (ii) According to Indian standard the displacement of the beam comes in building is limited. (iii) According to IS 1893:2002, the maximum drift in the building is safe. i.e 2.077 cm. (iv) the allowable displacement is 12 mm and maximum beam displacement of 3 m span is 0.044 mm.

TYPES OF STRUCTURAL LOAD

Dead load

These loads are non-operating and they are fixed slab weight, weight of column, weight of beam and weight of floor. The constant load in a structural building, bridge and machine, is due the weight of the component of the various structure, and permanent accessories and joints. Unit weight of concrete is 24 to 25 KN/M^2.

Live load

Those loads are movable load such as human being in building, furniture on floor etc. and they are not fixed like slab weight, weight of column, weight of beam and floor weight. In Live load does not

include earthquake activity, snow, loads due to wind. The live load have been confirm in the design as per IS 875 (part 2)-1987, cause 3.1, 3.1.1 and 4.1.1 similar of the value specified by the IS code .we have been taken 2 KN/m^2 as a live load on all rooms and 3 KN/m^2 on staircase, passage and corridors.

Seismic load

Earthquake load is one of the basic concepts of earthquake engineering. This means that making the building a moment to apply to generate earthquake. To make the structure earthquake resistant, the basic time of the building while the trail should be STAAD supporters have been search and provided as input for seismic analysis. In the weight according to X-direction and Y-direction STAAD Pro did all the loading as per IS1893:2002.

The Different Zone Factor In India

Model	Zone Factor	Soil Type
M1	II	Medium
M2	III	Medium
M3	IV	Medium
M4	V	Medium

Salient Feature Of Plane

Sr.No.	Description	Dimension	Unit
1	Length	16	M
2	Width	16	M
3	Height	24	M
4	Thickness of walls	0.23	M
5	Thickness of parapet walls	0.115	M
6	Height of parapet walls	1	M
7	Size of column	0.3 X 0..40 0.23 X 0.30	M M
8	Size of beam	0.23 X 0.23 0.23 X 0.30	M M
9	Grade of concrete	25	N/mm^2
10	Grade of steel	415	N/mm^2
11	Live load	2.5	KN/m^2
12	Floor height	3	M

MODELING AND ANALYSIS

Analysis of G + 7 residential building using STAAD pro

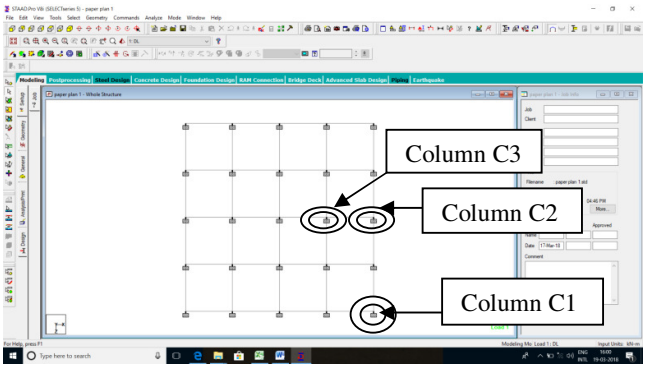


Fig.1 Column position

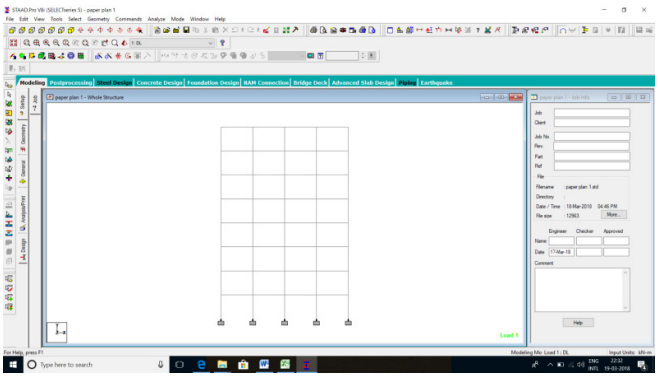


Fig. 2 Elevation

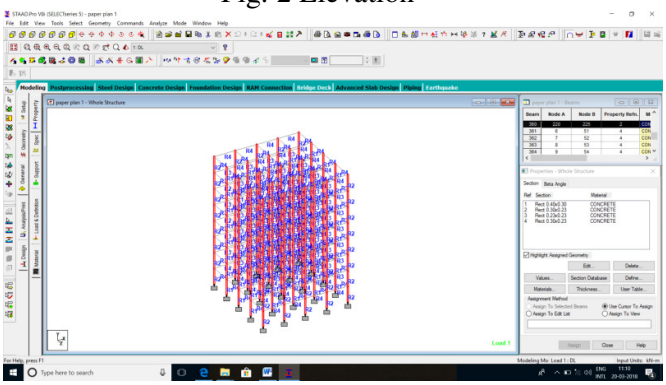


Fig.3. Member properties of columns.

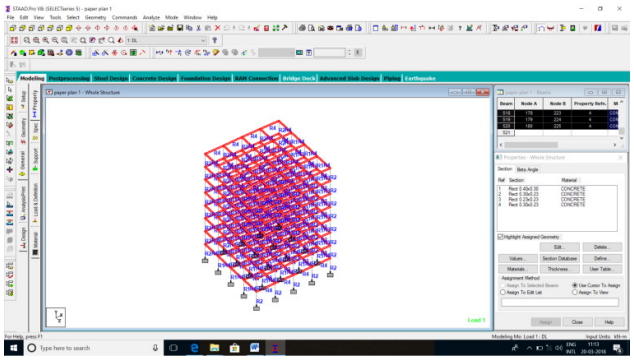
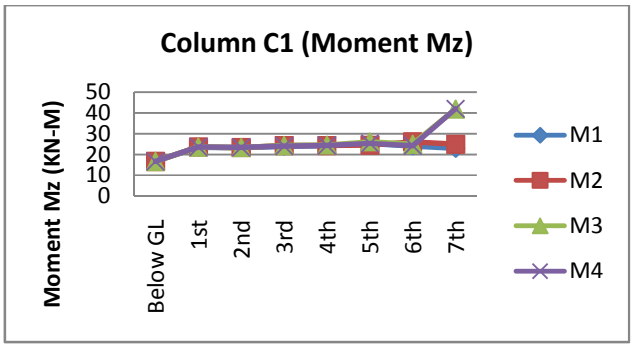


Fig. 4 Member properties of beam.

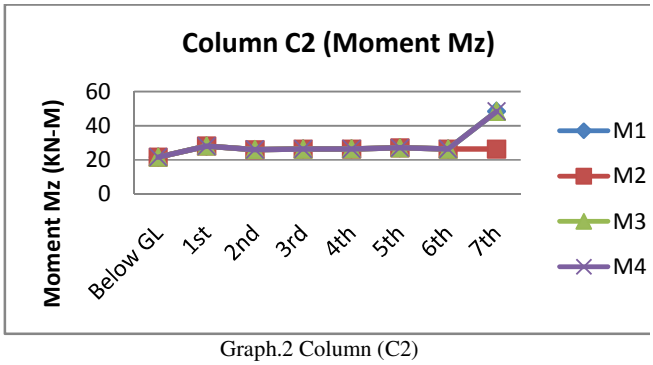
Moments

For Column 1



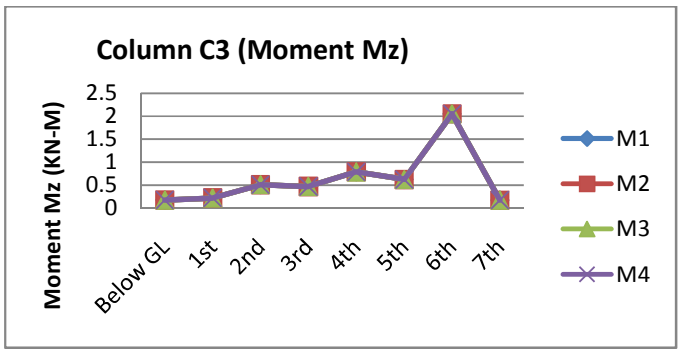
Gragh.1 Column (C1)

For Column 2



Graph.2 Column (C2)

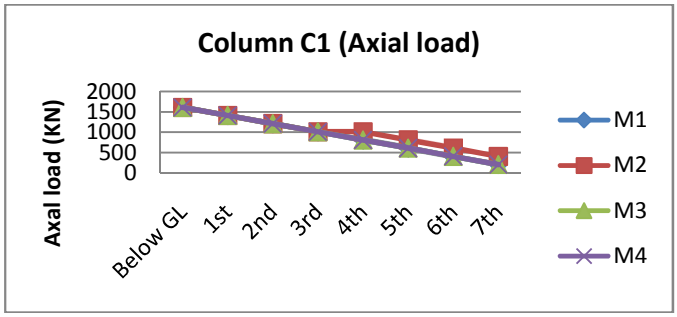
For column 3



Graph 3 Column (C3)

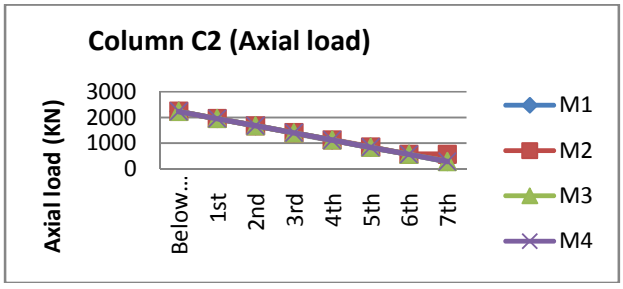
Axial Load

For Column 1



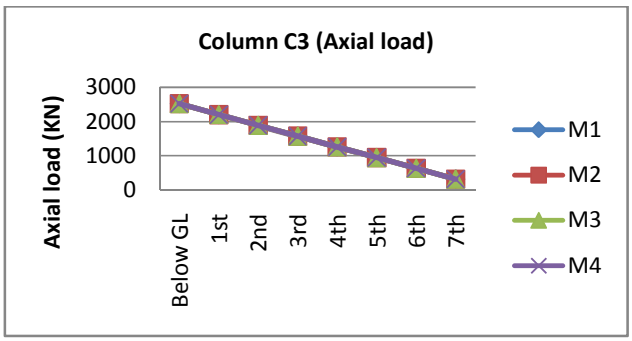
Graph 4 Column (C1)

For column 2



Graph 5 Column (C2)

For column 3



Graph 6 Column (C3)

CONCLUSION

The following conclusions are made along with moment and axial load.

1) By comparing different models of M1, M2, M3, M4 it is found that the column situated at the corner named as C1, generating high moment values as the zone of earthquake changes gradually increasing 5 to 10 %. (mention in graph 1)
2) The column C2 which is situated at the edge of the structure shows the same phenomenon of graduating moment when compared with different zoned of models. (mention in graph 2)
3) The column which is situated at the center of structure named as C3 shows the similar behavior in every model having different zone.(mention in graph 3)
4) The column C1 is also been observed that, column C1 carrying an axial load as the variation in axial load from 4^{th} floor to 7^{th} floor (in model 2) that is M2, but rest of the model shows the same axial load similar to each other. (mention in graph 4)
5) The column C2 & C3 carrying axial load is similar in all model i.e. M1, M2, M3, M4 for every floor.(mention in graph 5 & 6)

From the above study, it can be proposed that as the zone changes moment on the column gradually changes. This is all due to lateral force acting on the structure due to seismic loading.

REFERENCES

1) *Akshay R. Kohli, Prof. N. G. Gore. "Analysis and Design of an Earthquake Resistant Structure using STADD. Pro". International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395-0056, p-ISSN: 2395-0072 - Volume: 04 Issue: 12 | Dec-2017*
2) *S.Ramanarayan, A.Manjunath, K.V.R SatyaSai, S Lokeswari."seismic analysis and design of residential building (g+4) using staadpro". Indian J.Sci.Res.17(2): 440 - 448, 2018,ISSN: 2250-0138.*
3) *K. Aparna Srivastav. "seismic analysis & design of G+5 residential building". ". International general of latest trends in engineering and technology (IJLTET).*
4) *Amit Kumar, Anant Kumar, Shyam Kishor Kumar, Krishna Murari. "Analysis And Capacity Based Earthquake Resistant Design Of Multi Storeyed Building". IOSR Journal of Engineering (IOSRJEN), ISSN (e): 2250-3021, ISSN (p): 2278-8719 Vol. 04, Issue 08 (August. 2014), ||V1|| PP 07-13.*
5) *TejashreeKulkarni, SachinKulkarni, AnjumAlgur, M. H. Kolhar. "analysis and design of high rise building frame using staad pro". IJRET: International Journal of Research in Engineering and Technology, eISSN: 2319-1163 | pISSN: 2321-7308.*