Analysis of G+12 Building in Different Seismic Zones

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***Abstract*— Modern multi-storey buildings (G + 12) are most common due to land scarcity in India. Now a days Earthquakes have a profound effect on construction. Basically an earthquake is the cause of an earthquake vibration in a building also causes extensive damage. For example, the earthquake in Nepal happened month 25 April, 2015. Building analysis on an integral part of the design and evaluation of earthquakes. It began more than 100 years ago, when static analysis with side luggage about 10% of the weight of the structure was adopted by earthquake laws. For a long time the severity of the earthquake of this size remained largely codes for earthquakes around the world. Strong analysis is time dependent and paired analysis methods, one is the Response spectrum method and the other method of time history. In this work, the article is carried on comes out with a Response spectrum analysis of the (G+20) structure inside a separate earthquake zone (II, III, IV and V) using Staad Pro v8i software. Compared to the four different areas, the results of the analysis are based on lateral conditions modification, relocation, upper floor cutting, Axial strength, and moment of bending and given to results.**

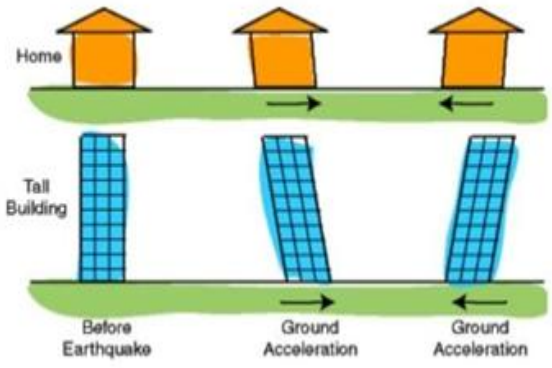
Index Terms: **Seismic analysis, STAAD pro, Seismic zone.**

1.INTRODUCTION

India is a developing country and currently modern houses are being built in our country per day. Huge and impressive structures such as monuments and high-rise buildings testify to the growth of civilization and the prosperity of our country. Modern construction requires less time under adverse conditions, design optimization, more serviceability and durability. Today, the construction of sky scrapers occurs very frequently in metropolitan areas (e.g. Mumbai, Delhi, Kolkata) due to the lack of area and population growth of there will not be enough room for superstructures in the next few years and the number of vertical superstructures will increase significantly to the vertical structure is multi-storey, with stories increasing to stories, and it will suffer from the effects of earthquakes and wind loads. Also increase the consumption of materials (cement, steel, etc.) and the cost of projects. This is why structure optimization is necessary, and calculating the structure manually is very time consuming. Software such as Staad Pro, Etabs, Tekla design helps reduce the time to calculate structural details, structure, stability and more. This study helps to evaluate the structural behavior of different lateral systems, structures under seismic loading in various domains.

2. EFFECT OF EARTHQUAKE ON TALL BUILDING

Earthquakes are a devastating natural disaster that did not previously foresee. Seismic building does not exist in the real world. The seismic design is in seismic calculations, the "mass" of a building is related to the "stiffness" of the building. Earthquakes cause an "force of inertia" which is proportional to the "mass" of the building. Earthquake forces increases direct proportional with ground acceleration and mass of the building. This implies that Newton's law,



(F =ma); 'F' represents force, 'm' represents mass, 'a' represents acceleration.

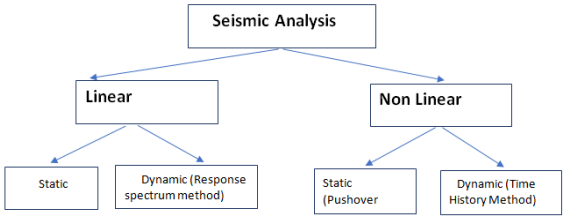
Small buildings effected by high frequency wave (short and frequent wave). Tall buildings effected by long period or slow shaking. (F=1/T; F represents frequency; T represents time). Increasing the height of the column reduces the stiffness of the and reduces its vibration or frequency.

3. ZONES OF EARTHQUAKE IN INDIA

Based on previous seismic history and tectonic structure, the Department of India recently divided India into 4 zones (Zone ii, Zone iii, Zone iv, Zone V). (IS 1893:2002) Here the 1st and 2nd zones are merged. In the past, the earthquake zone was divided into five zones according to the intensity of the earthquake. Zone Ⅴ It is the most dangerous earthquake zone with a seismic intensity of . The modulus of Zone is 0.36. Zone ⅴ includes Jammu and Kashmir, Ladakh, Himachal Pradesh, Uttarakhand, North Bihar, and parts of the islands of and Nicobar, where Kutch entered Gujrat and Andaman. Zone Ⅳ This Zone is called the High Risk Zone. The zone coefficient is 0.24. Zone iv includes the rest of Jammu and Kashmir, Ladakh, Himachal Pradesh, Union Territory Delhi, Sikkim, Northern Uttar Pradesh, Bihar West Bengal, parts of Gujarat and a small part of Maharashtra on the west coast . Rajasthan. Zone III This zone is referred to as the Medium Damage Hazard Zone. The zone factor is 0.16. This district includes the rest of Uttar Pradesh , West Bengal, Gujrat, parts of Punjab, Karnataka, Tamil Nadu, Orissa, Jharkhand, Maharashtra, Chhattisgarh, the rest of Bihar, Madhya Pradesh, Rajasthan, Island Kerala. Lakshadweep. Zone Ⅱ This zone is referred to as the Low Damage Risk Zone. The remaining India are included in this area.

4. TYPE OF SEISMIC ANALYSIS

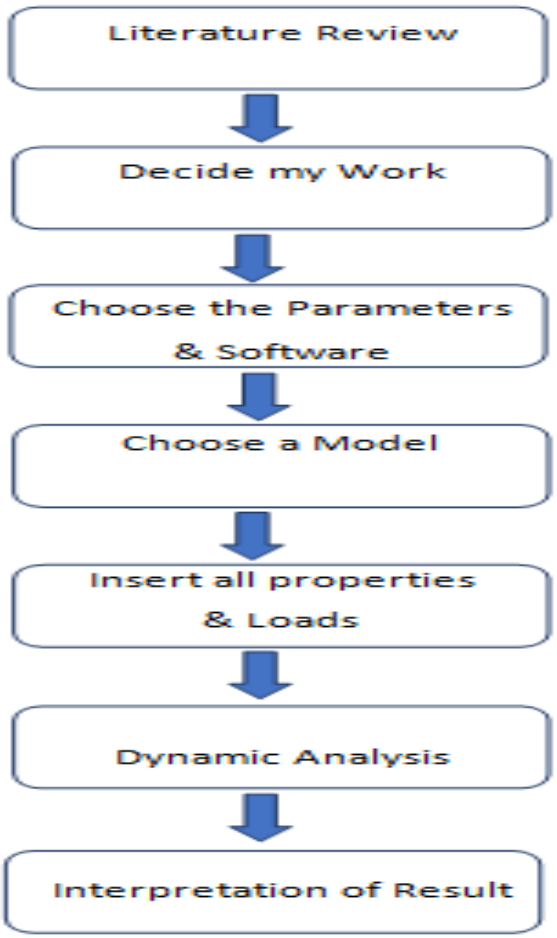
To determine seismic resistance, a seismic analysis of the structure must be performed. A analysis can be performed based on several factors such as external influences, the behavior of structural materials, and the type of model selected. Analysis can be categorized as:



5. OBJECTIVES

The purpose of this work is to analyze and study the behavior of structure(displacement, maximum floor movement, bending moment, axial force of different columns) of multi-story building G+12 in different seismic zones. (II,III, IV, V)Apply the dynamic analysis method (spectral method Response) using STAAD Pro software.

6.METHODOLOGY

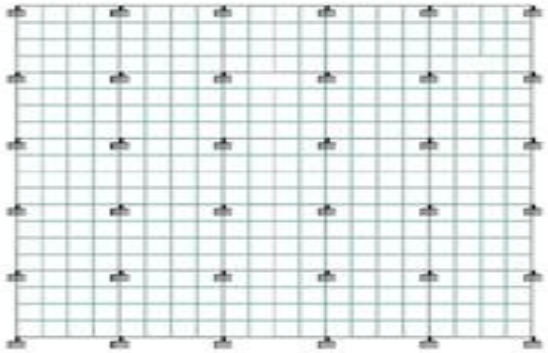


7. SPECIFICATION OF THE MODEL

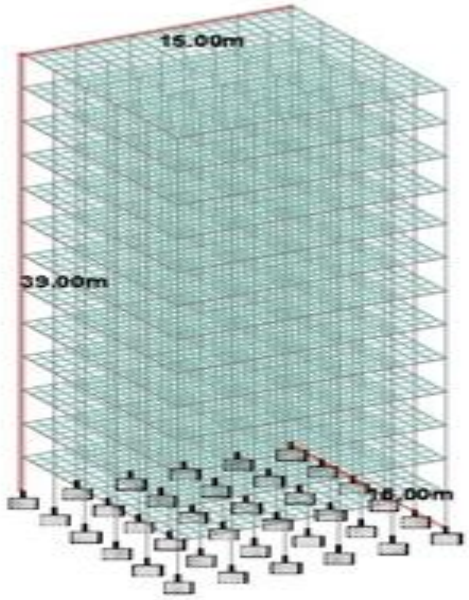
i.Plan Details

Model X is 15 m long, Zis 15m wide, and Y is 39 m (G+12) high, with 3 m Hight and

floors with 3 m height each floor. Models were created with Staad Pro software:



G+12 BUILDING TOP VIEW



G+12 BUILDING

Member Loading

All members were assigned the following loads:

• Self-weight
• Live load
• Seismic load according to IScode: 1983:2002/2005
• It is assumed that wind force does not affect the effectiveness of the frame.

Load Combination

In this project, you create load combinations during the analysis process. The generated load combination is the combination of the loads generated according to the code, and for this project it is the load generated in STAAD Pro as it follows the Indian Standard Design Criteria. The V8i is based on a specific design type using IS1893:2002/2005. Load combinations are created as follows:

Table:- Load case details

Load case No.	Load Cases
1	D.L
2	L.L
3	EQ_X+VE
4	EQ_X-VE
5	EQ_Z+VE
6	EQ_Z-VE
7	1.5(D.L+ L.L)
8	1.2(D.L + L.L +EQ_X)+VE
9	1.2(D.L + L.L +EQ_X)-VE
10	1.2(D.L + L.L +EQ_Z)+VE
11	1.2(D.L + L.L +EQ_Z)-VE

8. LITERATURE REVIEW

Kuldeep dubey & Rakesh patel (2018) - floating column then the cost of building is increases due to increase in reinforcement & concrete but building gives satisfactory results and the with floating column.

Anes B et al. (2017) - deal with effect of steel bracings on RC framed structures. Reinforced concrete building (G+9) was shaped and analysed in three parts comprising model sans steel bracing and shear wall, with dissimilar bracing systems, with shear wall. Bracings and shear wall were positioned at the middle bays and all these simulations were analysed for seismic forces at seismic zones II, III, IV and V using ETABS 2015. As per conclusion chevron category of steel bracing was originate to be more effectual in zones II and III, X type bracing was originate to be more effective in zones IV and V. Steel braced building significantly decreases the lateral drift when associated with shear wall building.

Rakshith (2017) - examined effect of bracings on Multi-Storied RCC building under dynamic loading. RCC building (vertical regular and vertical irregular) having (G+9) stories with different bracing systems

were analysed by response spectrum method using ETABS. Outcomes corresponded to displacement, storey drift and storey shear was compared. In this research , researchers concluded that both regular and irregular RCC frame structures X- bracing gives less displacement, storey drift and base shear. Regular frame bears more stiffness than irregular frame. Steel bracing were used to strengthen and retrofit existing structures.

Mohammad A. et al. (2016) - donea numerical approach to show dissimilarity between shear wall and steel bracing systems. The new methodology of this research was to strengthened lateral force resisting system via steel bracing. A measured has been done step by step to show understandable contrasts between systems. The overall investigation has been carried out by response spectrum using ETABS 9.7 that is of six case studies. It is coherent that model 1 (shear wall at core) is the safest among six models assessed in the research tenacity. Positioning of shear wall is a principal point. Besides, the orientation in floor bracing is of less significant dissecting with the vertically oriented bracing systems. Further modification in floor bracing will escort good formulation as seismic force resisting system.

Anirudh Gottala, Kintali Sai Nanda et al (2015) - has done comparative study of static and dynamic seismic analysis of a tall building. A multi-storied framed structure of (G+9) pattern has been selected. Seismic analysis linearlyhas been done for the tall building by static method (Seismic Coefficient Method) and dynamic method (Response Spectrum Method) using STAAD-Pro as per the IS-1893-2002-Part-1. A comparison has been done between the static and dynamic analysis and the results such as Bending moment, Nodal Displacements, Mode shapes are computed, compared and summarized for Beams, Columns and Structure as a whole during both the analysis

9. SCOPE OF PROJECT

1. This study uses response spectrum analysis. It can be extended to weak analysis. Pushover analysis is an efficient analysis tool., simple analysis can be easily performed in this way.

2. In this study, simple R.C. You can select the frame with the slab and add another element, such as a shear wall, to control effects and more.

3. In this study, an analysis is performed on a steel structure which can be analyzed in a similar way.

4. Economical buildings can be decorated in the style of minimalism.

10. RESULT &CONCLUSION

From the above analysis work and the results obtained with STAAD Pro, it was found that:

1. Steel changes significantly from Zone II to Zone V. That is, it increases from region II to region V, and from II to region.

2. The volume of the concrete also increases from zone II to zone V due to the increased support response.

3. The lateral force and bending moment of the central span for all zones are zero.

4. Constant Beam Deflection

REFERENCES

[1] Kuldeep dubey and Rakesh Patel (2018)- Reliability Analysis of Multi-Storey Buildingwith Floating Column for Long Span, IJIRSET, Vol. 7, Issue 9, September 2018

[2] Anes B et al. (2017) [1] “Effect of Steel Bracings on RC Framed Structure” ISSN 0973-1881 Volume 12, Number 1 (2017), pp. 97-112

[3] Rakshith K L, Smitha (2017), “Effect of Bracing on Multi-Storey RCC Frame Building under Dynamic Loading”, International Journal of Advance Research, Ideas and Innovations in Technology, Volume 3, Issue 4.

[4] Mohammad. A, Syed H (2016), “Comparative Study of Seismic Analysis of Multi-Storey Building with Shear Wall and Bracing Systems”, International Journal of Advanced Structures& Geotechnical Engineering, Volume 5, No. 3.

[5] Anirudh Gottala et. al. (2015)[5] “Comparative Study of Static and Dynamic Seismic Analysis of a Multistoried Building” - International Journal of Science Technology & Engineering | Volume 2 | Issue 01 ISSN (online): 2349-784X

[6] IS: 1893 (Part 1), (2007), Indian Standard Criteria for Earthquake Resistant Design of

Structures, Bureau of Indian Standards, New Delhi.

[7] IS: 875 (Part 1): Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures. Part 1: Dead Loads (Second Revision) (1987).

[8] IS: 875 (Part 2): Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures. Part 2: Imposed Loads (Second Revision) (1987).

[9] IS: 13920, (1993), Indian Standard Code of Practice for Ductile Detailing ofReinforced Concrete Structures Subjected to Seismic Forces, Bureau of Indian Standards, New Delhi.

[10] Duggal S K (2010). "Earthquake Resistance Design of Structure", Fourth Edition, Oxford University Press, New Delhi.

[11] Rakesh khare, "Computer aided earthquake resistant analysis and design of R.C.Cframe" Lambert academic publishing, ISBN: 9786202017473

[12] Himanshu Bansal et. al. (2013)[4]"study on storey shear force was found to be maximum for the first storey and it decreased to a minimum in the top storey".

[13] Md. Arman Chowdhury, (2012) [6] "Comparative study of the Dynamic Analysis of Multi-storey Irregular building with or without Base Isolator". 10. IS: 875-1987 (part-1) for Dead Loads, code of practice of Design loads (other than earthquake) for buildings and structures.

[14] IS: 875-1987 (part-2) for Live Loads or Imposed Loads, code of practice of Design loads (other than earthquake) for buildings and structures.

[15] IS 456:2000 Plain and Reinforced Concrete - Code of Practice is an Indian Standard code of practice for general structural use of plain and reinforced concrete 16. Arbaj Kd, Rashmi S, Nitin T. Time History Analysis Of Elevated Circular Tank. J Struct Eng 2018;7:1–11. https://doi.org/10.26634 /jste.7.2.14485.