COMPARATIVE STUDY OF ANALYSIS OF G+6 BUILDING IN STAAD PRO FOR DIFFERENT ZONES

Subhangi.R.Meshram[1], Prof.G.D.Dhawale[2], Prof.V.A.Kalmegh[3]

[1]M-Tech Student, Bapurao Deshmukh College of Engineering, Sevagram, Wardha

[2]Guide, Bapurao Deshmukh College of Engineering, Sevagram, Wardha

[3]Co-Guide, Bapurao Deshmukh College of Engineering, Sevagram, Wardha

ABSTRACT: Designing the structure in such a way that damage reduction is made during an earthquake, as the earthquake may or might not be a rare phenomena in its lifetime. This article analyses and designs an existing structure of the G+6 RCC framework with the help of the STAAD.Pro V8i. The construction is intended for earthquake forces in seismic areas according to IS 1893(Part 1):2002. The major aim of this work is to compare the variation of the steel %, maximum shear strength, maximum bending time and maximum deflection in seismic areas. Variations from zone II to zone V are significantly higher. The steel percentage is increased from zone II to zone V with a maximum shear forces, a maximum bending time and a maximum bending force.

KEYWORDS: STAAD.Pro, steel percentage, Maximum Shear force, Maximum Bending Moment, Maximum Deflection, Seismic zones.

I. INTRODUCTION

A lot of research has taken place and is still going on, because we can minimise damages more and save lives by trying to learn more. Studies of seismology have shown that approximately 90% of the earthquake is due to tectonics. When we get to civil engineering the task of an engineer is to ensure maximum safety and to maintain the economy in structure designed.

In terms of area factors, India is assigned four levels to the most recent version of the Indian seismic zoning map, which appears in Indian Earthquake resistance code [IS 1893 (Part 1) 2002]. In other words, as opposed to its previous version consisting of five or six zones, India's earthquake zoning map divided into 4 seismic areas (zones 2, 3, 4 and 5). Zone 5 is expected to have the highest degree of seismicity according to the present zoning map while Zone 2 is associated with the lowest degree of seizure. Zone 5 covers areas that suffer from the highest-risk MSK IX or higher intensity earthquakes. Zone 0.36 is assigned for Zone 5 with the IS code

For earthquake-resistant design of structures in Zone 5, structure designers use this factor. In this area, zone factor 0.36 indicates that the earthquake in this zone is effective (zero periods). The Very High Risk Zone is called this. In this zone fall the Kashmir region, the West and Central Himalayas, North and Middle Bihar and the Kutch Rann region.

The High-Damage Risk Zone is Zone 4 and encompasses MSK VIII-responsible areas. Zone Factor 0.24 is assigned for Zone 4 by the IS code. Zone 4 coincides with the Indo-Gangetic Bassin, Delhi capital, Jammu and Cashmir. Also in zone no. 4 is the Patan area in Maharashtra (Koyananananager). In Bihar, the northern part of the country, such as Raksaul, lies near the border between India and Nepal.

Zone 3, Andaman and Nicobar Islands, Kashmir areas, Western Himalaya are falling within that area. This zone is classified as MSK VII Moderate Damage Risk Area. For Zone 3, Zone factor 0.16 is assigned to the IS code.

Zone 2 shall be liable for or below MSK VI and shall be considered as a zone of low risk damage. The IS code assigns the zone factor of 0.10 (10% of the gravitational acceleration for a structure that can be seen in this area) to Zone 2.

Since India is now divided into Zone 1 hazardous areas, no area is classified as Zone 1. This zone may, or may not, be returned to use future changes in the classification system.

STAAD PRO

STAAD is Bentley-licensed powerful design software. Any object stable under a given loading can be considered structure as structure for structural analysis and design. First, the structure outline can be identified, whereas analysis is used to evaluate what types of loads are affecting the beam and calculating the shear strength and bending moment is being analysed. The design phase designs the type and the dimensions of the materials for resistance to load. After analysis, we do this It takes approximately an hour to calculate a shear power diagram and bending moment of a complex beam. It will therefore take a week when it enters the building with several members. STAADPRO is an extremely powerful tool that performs this task in an hour. For high-ranking buildings, Staad is the best option.

II. RELATED WORK

Papa Rao and Kiran Kumar (2013): The author studies changes in steel % and concrete volume of the framed RCC construction for various India's seismic areas. They have the gravity load structure and seismic forces designed, which could affect construction. They found according to their research, that variance in the background reactions in external columns rose from 11.59% to 41.71% and in the case of edge columns from Zone II to Zone V is 17.72 to 63.7%, and, as in the case of internal columns, is much less. For the external and edge columns of zones III to zones IV, the amount of concrete has been increased because the supporting reactions to lateral force have increased, and variation on the inside columns is very small. Steel variations in external beams are 0.54% to 1.23% and in internal beams 0.78% to 1.4% are observed. For seismic and non-seismic design the lower reinforcement is not changed.

Perla Karunakar (2014): The author has been working to find out how the steel percentage and concrete quantities are performing and differing in different seismic zones and how they affect building costs as well. According to his research, the amounts of concrete are increased in exterior and edge columns, however due to increased support reactions. Strengthening variation between gravity and seismotic loads for the entire structure is 12,96, 18,35, 41,39, and 89,05%. Ductile versus non-ductile detailing cost differences are 4.06%.

Salahuddin Shakeeb S M, Prof Brij Bhushan S, Prof Maneeth P D, Prof Shaik Abdulla (2015): The work seeks to identify the required percentages from the effects of infill and without infill for different seismic zones. A symmetry-based construction plan with 13 levels is used for the study, analysed and developed using the ETABS-2013 software structure analysis tool. The study also determines the base shear, shift, moment and shear and compares results between gravity loads and different seismic zones. These parameters also take into account the effects of maceration. The research concludes that in columns with maximum seismic zone 2 load, the total change in percent steel is 1,935 to 51,612 percent compared to gravity loads. The total difference between 1.24% and 9.12% compared with gravity loads is the overall variance of the percentage steel for columns with maximum loading from seismic zone-2 to zone-5. For infill case with maximum loading from Zone-2 to Zone-5, the amount of variation in percent steel beam variation from 2.7% to 16.21% compared to the weight and the variation of the percentage of steel in beams with maximal load from Seismic zone-2 to Zone-5 are 16.66% to 58.75% compared to gravity loads.

Inchara K P, Ashwini G (2016): The main objectives of this study were to investigate the performance and variation of the percentages of steel and the quantities of concrete in R.C. And to know how to compare a percentage and quantities of concrete steel reinforcement when the building is designed to be of gravity load in accordance with IS 456:2000 and when the building is designed for seismic forces in different seismic zones under IS 1893(Part 1): 2002. Five (G+4) models were taken into account in this study. For gravity loads and earthquake forces in the various seismic zones, all four models were modelled and analysed. For model analysis, ETABS software was used. Their research suggests that support reactions have increased as the area varied between II and V, which in turn increased steel reinforcement volume and weight on the footing and in the case of beams, the percentage of steel reinforcement increased through zones II to V.

III. METHODOLOGY

The structures are seismically analysed using a lateral force that is assumed to act in conjunction with gravity loads. Seismic evaluation of existing residential buildings for various seismic zones is carried out in this project by using the STAAD.Pro software to perform an equivalent static analysis.

Table 1 - Structural properties used for building

PRELIMINARY DATA OF THE STRUCTURE CONSIDERED FOR ANALYSIS AND DESIGN

STRUCTURAL PROPERTIES OF RCC FRAME STRUCTURE	
Number of Stories	G+6
Floor to Floor Height	3.5m
Plinth Height	3.5m
Earthquake Load	As Per IS 1893:2002
Slab Thickness	0.15m
Wall Thickness	0.23m
Live Load	3 kN/m^2
Floor Finish	1.5 kN/m^2
Seismic Zone	All Four Seismic zones
Type of Soil Taken	Medium

Table 2 - MATERIAL PROPERTIES

These are the properties of material used in building designing

MATERIAL PROPERTIES	
Grade of Concrete	M25
Grade of Steel	Fe500

Table 3: Column and beam data

Beam and Column	**Zone II**	**Zone III**	**Zone IV**	**Zone V**
Beam's size	230 x 450mm	230 x 500mm	230 x 500mm	230 x 500mm
Column's size	450 x 450 mm	500 x 500 mm	550 x 550 mm	600 x 600 mm

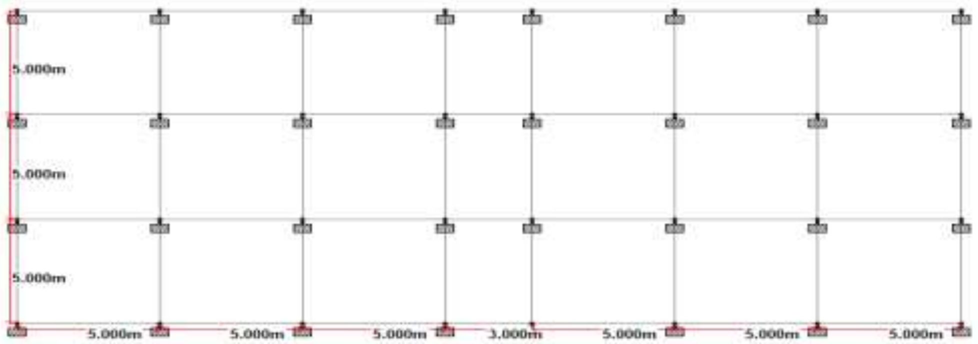

Fig 1: Plan of Building

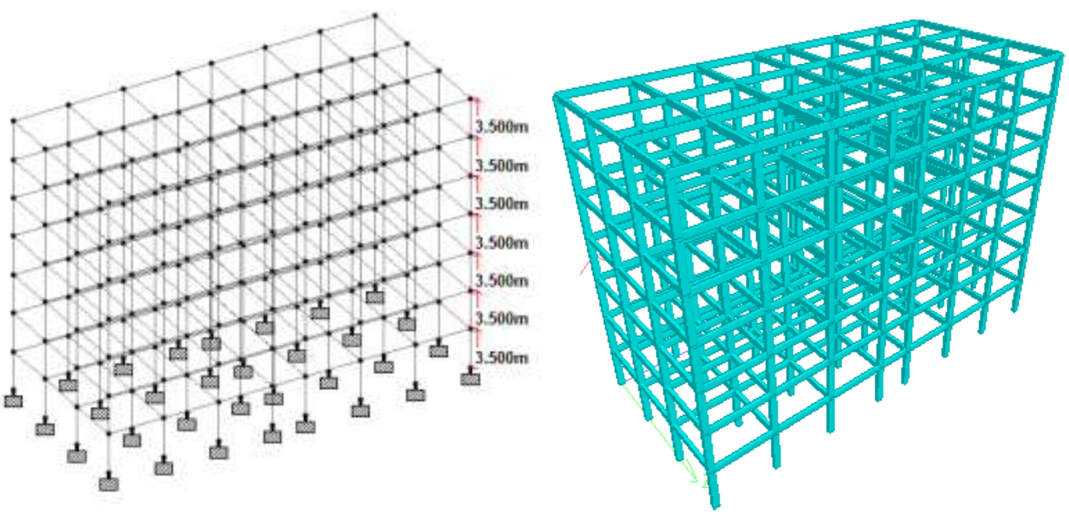

Fig 2: 3d and Rendered View of Building

IV. RESULTS & DISCUSSIONS

1. Bending Moment

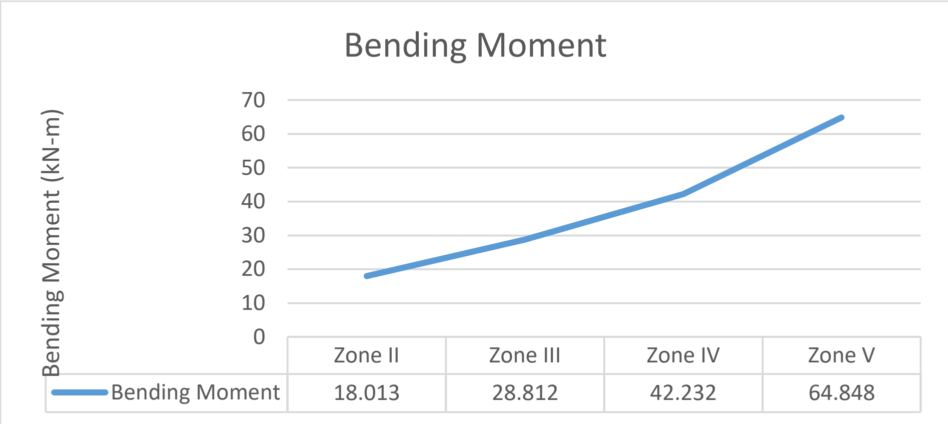

Figure 3:- Maximum Bending Moment

The Maximum Bending Moment in Structure is depicted in the graph above. The area of steel reinforcement in a structural member is directly proportional to the bending moment. As the zone expands, the force acting on the member expands as well, resulting in significant changes in the bending moment of the members.

2. Shear Force

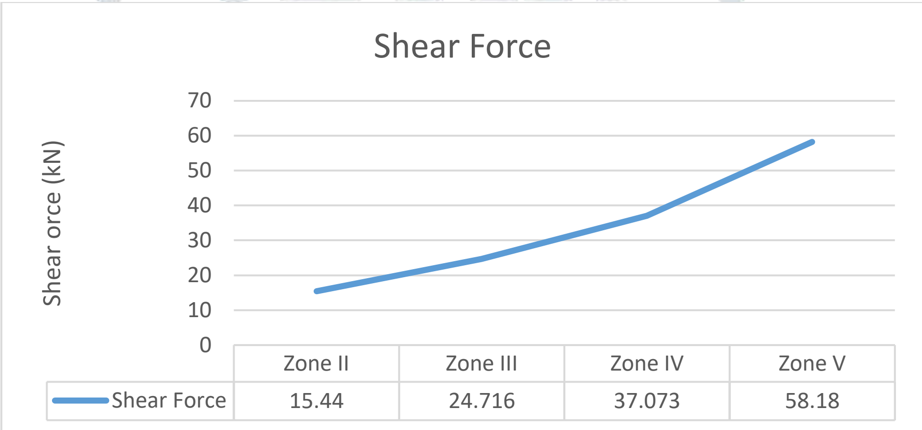

Figure 4:- Maximum Shear Force

The above Graph shows the Maximum shear force in Structure. Shear force is Directly proportional to area of confined reinforcement in structural member. The increase in shear force increases the shear reinforcement in the members and decreases the spacing between the two stirrups or shear reinforcement.

3. Displacement

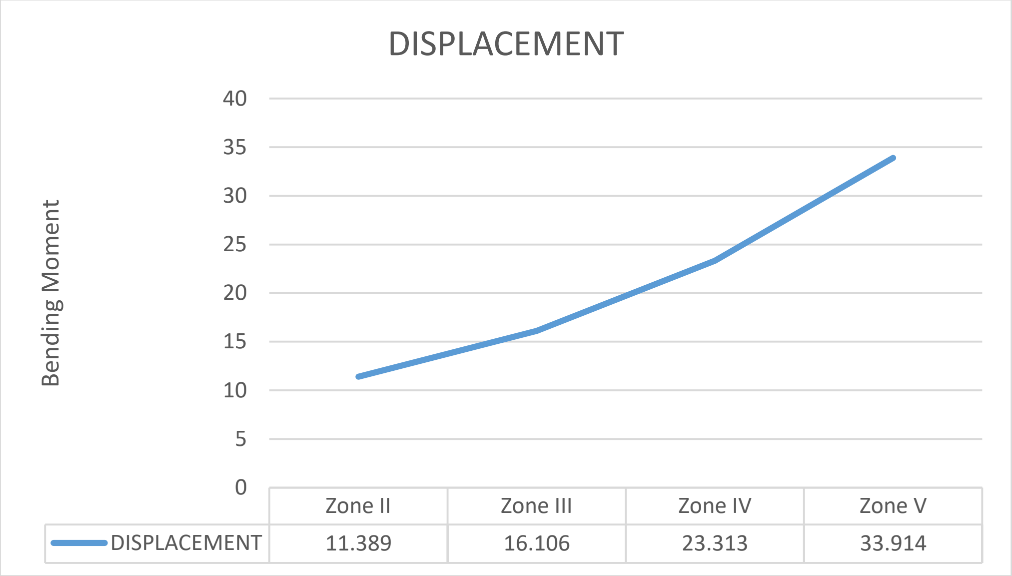

Figure 5:- Maximum Displacement

The above Graph shows the Maximum Displacement in Structure. The displacement in the structure is due to the seismic forces which makes the structure to slightly displace form its original position by applying the longitudinal force.

4. Support Reaction

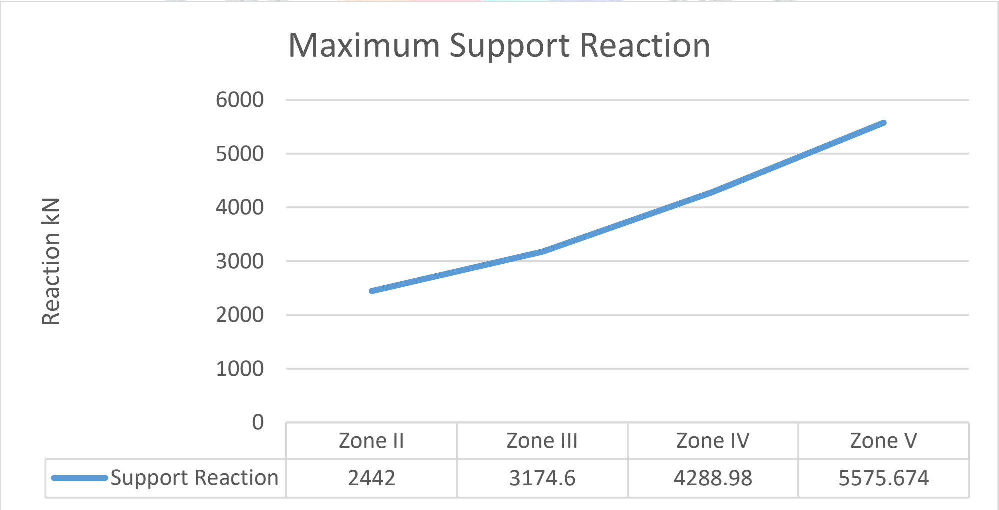

Figure 6:- Maximum Support Reaction.

The above Graph shows the Maximum support reaction in Structure. The support reaction is the additional of dead load, live load and the earthquake forces acting on the structure which is transferred from structure to foundation. The maximum reaction acting on a column is the maximum support reaction.

5. Quantity of Concrete

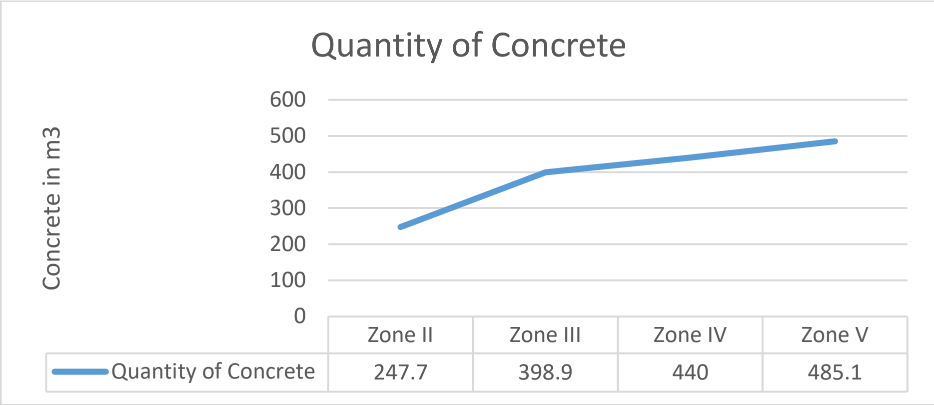

Figure 7:- Quantity of Concrete

The above Graph shows the Maximum Quantity of concrete in Structure. It is the total amount of concrete member on the structure. Here the size of column is increases with zone so the quantity of concrete is also increases.

6. Quantity of Steel

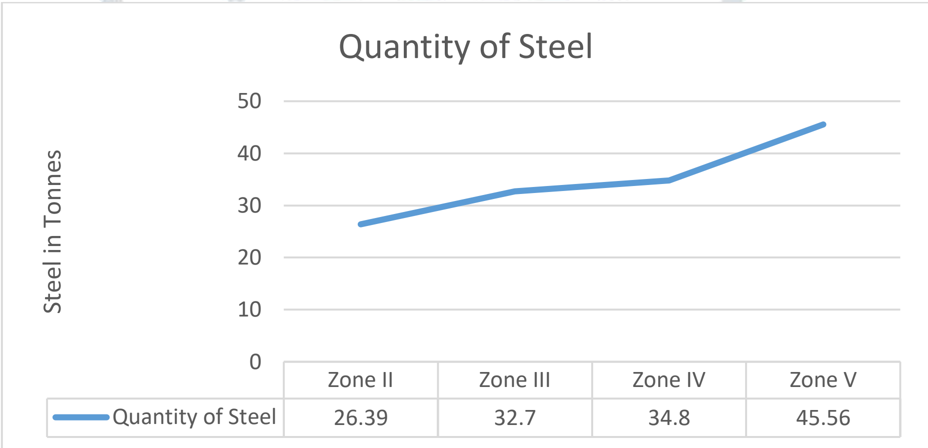

Figure 8:- Quantity of Steel

The above Graph shows the Maximum Quantity of steel in Structure. It is the total amount of steel reinforcement and confined reinforcement in structural members. Here the size of member increases thus the quantity of steel also increases.

V. CONCLUSION

From the above results it is concluded that.

1. The analysis result for the STAAD Pro. Shows the increase in shear force, bending moment, displacement and quantity of steel and concrete.
2. The maximum forces is seen in zone V and less in Zone II.
3. STAAD Pro. has some limitations while designing a strutucre as it does not optimize the structure so the quantity of steel reinforcement tends to increase more than usual as the number of story increases
4. In STAAD Pro. there is no such reduction in live load. So the forces gets increases and structure becomes heavy.
5. Overall the STAAD Pro. Is very useful for structural designing but with some limitations.

VI. REFERENCES

1. Mr. Kiran Kumar and Mr. Papa rao g (2013): “Comparison of percentage steel and concrete quantities of a r.c building in different seismic zones”, volume: 02.

2. Karunakar Perla (2014) “Earthquake Resistant Design- Impact on Cost of Reinforced Concrete Buildings” International Journal of Engineering Science and Innovative Technology (IJESIT) Volume

3. Salahuddin shakeeb s m,prof brij bhushan s, prof maneeth p d,prof shaik Abdulla (2015) “Comparative study on percentage variation of steel in different seismic zones of India”.

4. Inchara k p, Ashwini g (2016): A study on comparison of percentage steel and concrete quantities of a r.c irregular building in different seismic zones”.

5. IS: 1893 (part-I) 2002: criteria for earthquake resistant design of structures, part-i general provisions and buildings, fifth revision, bureau of Indian standards, new Delhi.

6. IS: 456-2000: Indian standard code of practice for plain and reinforced concrete.

7. IS:875 (part 1)1987 : code of practice for Design loads (other than earthquake) For buildings and structures Part 1 dead loads - unit weights of building materials and Stored materials (second revision).

8. IS: 875 (part 2)-1987: Code of practice (other than earthquake) part2: imposed loads (2nd revision)