Analysis & comparison of RC frame building in different seismic & wind zone (As per IS 1893 part -I & IS 875 part-III 2015)

[1] Deepesh yadav, [2] Shanti lal patel

[1] M.Tech scholar, [2] Assistant professor
[1]Department of civil engineering
[1]Pacific university, Udaipur, India

Abstract : Our study is based on non-linear structures type building which is carried out on mainly three different zone 3, 4 and 5. The analysis is done on Staad.Pro software. And as per Indian stander IS 875 part III 2015 and IS 1993 part I 2016 are using .The building model in the study has two structures one is ground + five (G+5) storey building and the second is ground+ ten (G+10) storey building. Twelve models are used to analyze with same length, width and same floor height. The depth of beam is also same. The objective of the present work is to study the behavior of a multi storied building irregular in plan subjected to wind load and earthquake load by adopting response spectrum analysis. In this study we have thoroughly done the comparison between earthquake load and wind load on the basis of storey height and in different zones which totally depends on the values of shear force, bending moment and deflection. The work I have performed here tells about the difference between the wind load and earthquake load in different zones according to deflection, shear force and bending moment. The deflection values of these loads in different zones vary a little and negligible. The same thing happens with the bending moment and shear force the values increases and decreases at each upper floor levels. The minimum deflection values of all these loads are equal to zero and maximum values of some wind loads differ with little values from earthquake load.

Structural engineers are facing the challenge of striving for the most efficient and economical design solution while ensuring that the final design of a building must be serviceable (deflection), flexure for its intended function. When a structure is subjected to earthquake, it responds by vibrating. An earthquake force can be resolved into three mutually perpendicular directions- the two horizontal directions (x and y) and the vertical direction (z)It is very essential to consider the effects of lateral loads induced from wind and earthquake in the analysis for high rise building.

IndexTerms - **Wind zone, Earthquake load, Shear force, Bending moment, Deflection.**

I. INTRODUCTION

Building is a part of structure which comes in a wide amount of shapes and built for various requirements.Human shelters were at first very simple and perhaps lasted only a few days or months. Some structures began to have symbolic as well as functional value, marking the beginning of the distinction between architecture and building. There is a wide range of building products and systems which are aimed primarily at groups of building types or markets.

A multi-stored is a type of building that has multiple floors above the ground in the building. A G+5 building has a ground floor and then above that 5 floors are attached. It is also known as six stored building. A multi-stored building has its foundation up to its level so that it can bear the weight of the building according for which it is to be constructed, it allows us to construct major building with large options without using much land area. The design process of multi-stored building requires not only imagination and conceptual thinking but also sound knowledge of science of structural engineering besides the knowledge of practical aspects, such as recent design codes, bye laws, backed up by ample experience, intuition and judgment. In order to design them, it is important to first obtain the plan of the particular building that is, positioning of the particular rooms.The structural systems of tall buildings must carry vertical gravity loads, but lateral loads, such as those due to wind and earthquakes, are also a major consideration. The effect of wind forces on tall buildings is twofold. A tall building may be thought of as a cantilever beam with its fixed end at the ground; the pressure of the wind on the building causes it to bend with the maximum deflection at the top. In addition, the flow of wind past the building produces vortices near the corners on the leeward side; these vortices are unstable and every minute or so they break away downwind, alternating from one side to another. The change of pressure as a vortex breaks away imparts a sway, or, to the building perpendicular to the direction of the wind. Thus, under wind forces there are several performances that a high-rise structure must meet. In this project we are actually designing the same thing , how to overcome the design problems for both earthquake load and wind load. How the building will behave in different zones is being calculated here on the basis of deflection , shear force and bending moment. According to the soil properties the building has it's foundation which also depends on building height, as we are doing project for G+5 building their foundation is upto that extent so that it could overcome the load such as wind load and earthquake load. The project simply tells us about the effects of deflection value, shear force and bending moment on each and every single node of the floor, how it changes what are the values of these loads for different wind zone and earthquake zone.

A G+10 building has a ground floor and then above that 10 floors are attached. It is also known as eleven stored building. Buildings are to be created unobstructed, column-free spaces greater than 30 metres for a variety of functions. These include activities where visibility is important for large audiences, where flexibility is important, and where large movable objects are housed. A tall building is constructed for various purposes, these buildings are not meant for single type of work their aim is to create a large space for different types of business. Each floor is built for some specific type of work. In such types of building, earthquake or seismic forces, unlike wind forces, are generally confined to relatively small areas, primarily along the edges of the slowly moving continental plates that form the Earth's crust. When abrupt movements of the edges of these plates occur, the energy release propagate waves through the crust; these waves of the Earth is imparted to buildings resting on it. That is why the foundation of the building are deeper for taller buildings so that less effect of earthquake load occurs on the building. Timber frame buildings are light and flexible and are usually little damaged by earthquakes; buildings are heavy and brittle and are destructible to severe damage. Continuous frames of steel or concrete fall between these extremes in their seismic zones, so they can be designed to survive with relatively little damage.

In this project, a detailed analysis of the deflection value, shear force and bending moment is carried out on each node of the floors and also for the different wind zones and earthquake zones. Same values are seen same for the building which are carried out for the G+5 building, the values are somewhere increasing and somewhere decreasing while calculating for the different floors and also in different zones.

II. RESULTS

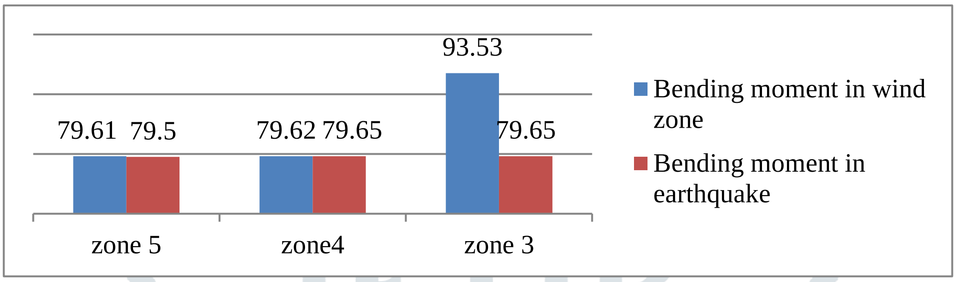

Fig.1 Bending moment for wind and Earthquake load in (G+5) building

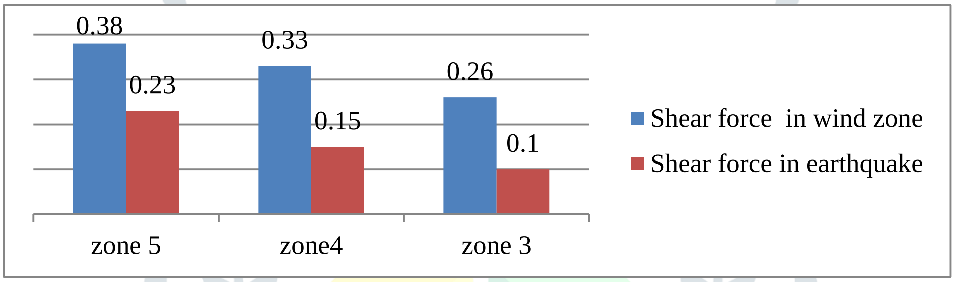

Fig.2 Shear force for wind and Earthquake load in (G+5) building

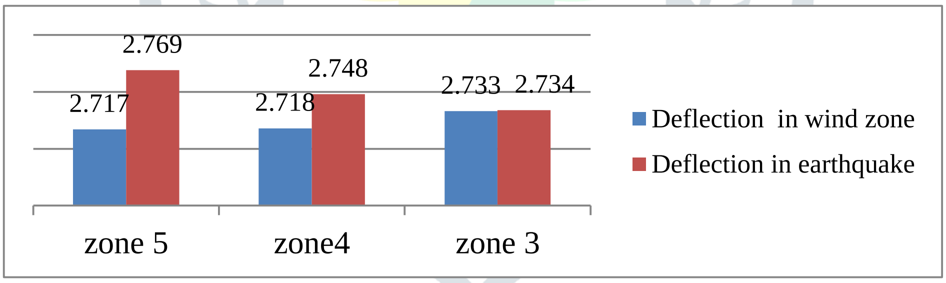

Fig.3 Deflection for wind and Earthquake load in (G+5) building

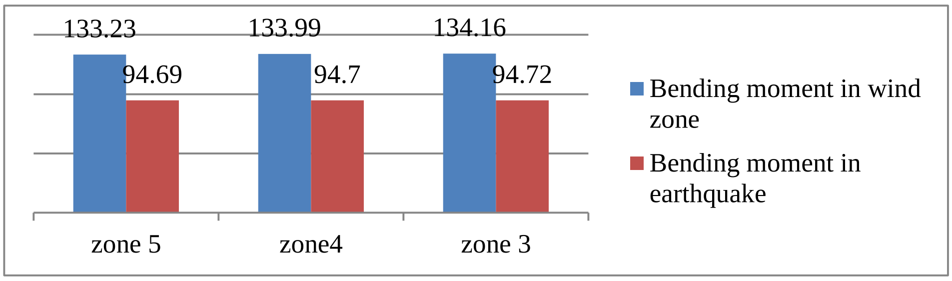

Fig.4 Bending moment for wind and Earthquake load in (G+10) building

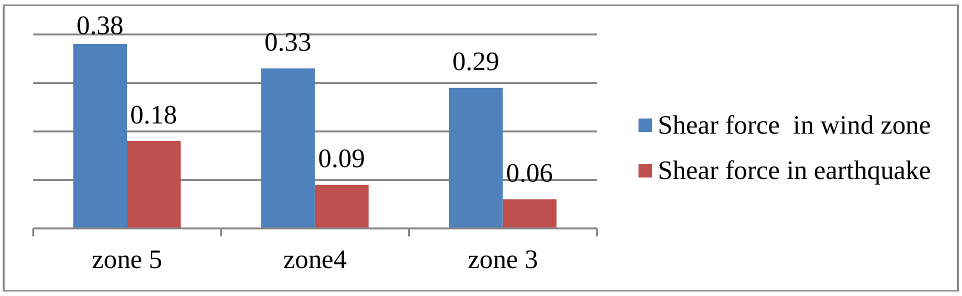

Fig.5 Shear force for wind and Earthquake load in (G+10) building

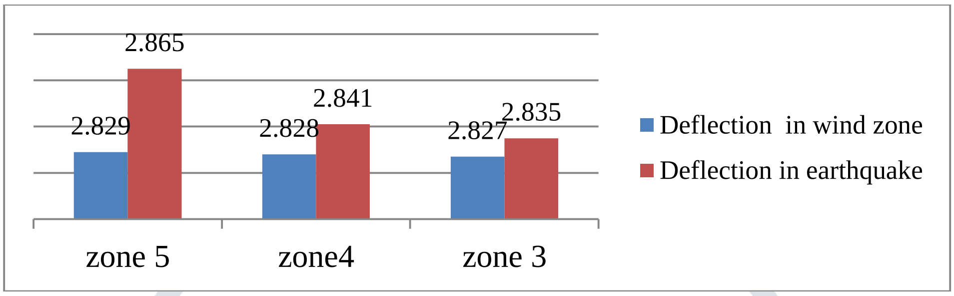

Fig.6 Deflection for wind and Earthquake load in (G+10) building

III. COMPARISONE

3.1 Comparison between wind and earthquake load for G+5 building

3.1.1 Bending moment

1. In zone 5 the value of bending moment is highest on sixth storey which is 79.61 KN-m for wind load and the value of bending moment is highest on sixth storey which is 79.50 KN-m for earthquake load.
2. In zone 4 the value of bending moment is higher on sixth storey which is 79.62 KN-m and the value of bending moment is highest on sixth storey which is 79.65 KN-m for earthquake load..
3. In zone 3 the value of bending moment is higher on sixth storey which is 93.53 KN-m and the value of bending moment is highest on sixth storey which is 79.65 KN-m for earthquake load.

3.1.2 Shear force

1. In zone 5 the value of shear force is highest on both second and third storey which is 0.38 KN for wind load and the value of shear force is highest on fifth storey which is 0.23 KN for earthquake load.
2. In zone 4 the value of shear force is highest on both second and third storey which is 0.33 KN for wind load and the value of shear force is highest on fifth storey which is 0.15 KN for earthquake load.
3. In zone 3 the value of shear force is highest on both second and third storey which is 0.26 KN for wind load and the value of shear force is highest on fifth storey which is 0.10 KN for earthquake load.

3.1.3 Deflection

1. In zone 5 the value of deflection load is highest on story sixth which is 2.717 mm for wind load and the value of deflection load is highest on sixth storey which is 2.769 mm for earthquake load.
2. In zone 4 the value of deflection load is highest on sixth storey which is 2.718 mm for wind load and the value of deflection load is highest on sixth storey which is 2.748 mm for earthquake load.

In zone 3 the value of deflection load is highest on sixth storey which is 2.733 mm for wind load and the value of deflection load is highest on sixth storey which is 2.734 mm for earthquake load.

3.2 Comparison between wind and earthquake load for G+10 building

3.2.1 Bending moment

1. In zone 5 the value of bending moment is highest on final storey which is 133.23 KN-m for wind load and the value of bending moment is highest on final storey which is 94.69 KN-m for earthquake load.
2. In zone 4 the value of bending moment is higher on final storey which is 133.99 KN-m and the value of bending moment is highest on final storey which is 94.70 KN-m for earthquake load
3. In zone 3 the value of bending moment is higher on final storey which is 134.16 KN-m and the value of bending moment is highest on final storey which is 94.72 KN-m for earthquake load.

3.2.2 Shear force

1. In zone 5 the value of shear force is highest on third storey which is 0.38 KN for wind load and the value of shear force is highest on tenth storey which is 0.18 KN for earthquake load.
2. In zone 4 the value of shear force is highest on third storey which is 0.33 KN for wind load and the value of shear force is highest on tenth storey which is 0.09 KN for earthquake load.
3. In zone 3 the value of shear force is highest on third storey which is 0.29 KN for wind load and the value of shear force is highest on tenth storey which is 0.06 KN for earthquake load.

3.2.3 Deflection

1. In zone 5 the value of deflection load is highest on final storey which is 2.865 mm for earthquake load and the value of deflection load is highest on final storey which is2.829 mm for wind load.
2. In zone 4 the value of deflection load is highest on final storey which is 2.841 mm for earthquake load and the value of deflection load is highest on final storey which is 2.828 mm for wind load.
3. In zone 3 the value of deflection load is highest on final storey which is 2.835 mm for earthquake load and the value of deflection load is highest on final storey which is 2.827 mm for wind load.

IV. CONCLUSIONS

The work I have performed here tells about the difference between the wind load and earthquake load in different zones according to deflection, shear force and bending moment. The deflection values of these loads in different zones vary a little and negligible. The same thing happens with the bending moment and shear force the values increases and decreases at each upper floor levels. The minimum deflection values of all these loads are equal to zero and maximum values of some wind loads differ with little values from earthquake load.

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I. ACKNOWLEDGMENT

Thepreferredspellingoftheword "acknowledgment" inAmericaiswithoutan "e" afterthe "g".Avoidthestiltedexpression, "Oneofus(R.B.G.)thanks..."
Instead,try"R.B.G.thanks".Putapplicablesponsoracknowledgmentshere;DONOTplacethemonthefirstpageofyourpaperorasafootnote.

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