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Analysis and Design of G+26 Multistoried Earthquake Resistant Building in Zone 4

M.Tech. Scholar Shyam Kumar, Prof. Imran Ahmad Faizy
Department of Civil Engineering,
MIT&S ,Bhopal,MP,India

Abstract- This research was carried out with an objective to determine the design loads of a G+26 multistoried building structure which is an earthquake resistant structure in Zone 4. The purpose of this investigation is to determine the design loads for a structure that will be subjected to seismic loads in a specific area. In this study, the response spectrum analysis was applied to a G+26-story building with the help of the programme STAD PRO V8i. Joint motion, axial forces, time, and mass were all measured and analysed. The dynamic analysis is performed with the aid of the design response spectrum curve proposed by the IS: 1893 Part-1 for seismic design. As the modal mass participation factor for the investigated building is greater than 75%, it was determined that the building is stiff for earthquake excitation. As the earthquake motion was applied in the X-direction, we see a greater X-direction joint displacement compared to what we expect.

Keywords- Analysis and Design, Earthquake Resistant, Seismic Load, Stability, Stiffness.

I. INTRODUCTION

The monetary development and fast urbanization in hilly area has sped up the land improvement and brought about expansion in populace thickness in the sloping district colossally. In this manner, there is famous and squeezing interest for the development of multi-story structures around there. A shortage of plain ground in hilly region constrains the development movement on slanting ground.

Slope structures act unique in relation to those in fields when exposed to horizontal burdens because of quake. Such structures have mass and firmness fluctuating along the vertical and level planes, coming about the focal point of mass and focus of unbending nature don't harmonize on different floors.

Additionally, because of uneven incline these structures step back towards the slope slant and simultaneously they might have difficulty likewise, having inconsistent levels at a similar floor level the section of slope building rests at various levels on the slant. The seismic reaction of multi-story structures can be improved by consolidating a shear wall.

Shear walls frameworks are one of the most ordinarily utilized sidelong burden opposing frameworks in elevated structures. Shear walls have extremely high in plane solidness and strength, which can be utilized to all the while oppose huge flat loads and backing gravity loads, making them very worthwhile.

Sufficient firmness is to be guaranteed in tall structures for protection from sidelong loads actuated by wind or seismic occasions. Built up substantial shear walls are intended for structures situated in seismic regions, on account of their high bearing limit, high malleability and unbending nature. So that, there is a great deal of stopping up at these joints and it is hard to put and vibrate concrete at these spots which doesn't add to the security of structures. These reasonable troubles call for presentation of shear walls in Tall structures.

Structures designed with underlying walls are quite often stiffer than outlined structures, lessening the chance of over the top distortion and consequently harm. At the point when such structures are planned without shear walls, pillars and segment sizes are very weighty. Shear walls may became basic according to the perspective of conservative and control huge deflection. Walls experience shear and overturning moments due to lateral forces, or the horizontally applied forces of wind or earthquakes.

The shear pressures tend to rip the wall apart like a sheet of paper linked to a frame whose shape has altered from a rectangle to a Parallelogram. Intense stresses, swaying motions, and vibrations can all result from lateral loads. So, it really is crucial that the structure has adequate strength to withstand vertical loads. The buildings are only vulnerable to severe lateral forces like earthquake and wind.

Systems and structures intended to withstand lateral loads must be able to bend or twist under the pressure of all these forces without breaking. The building's structural components, such as the structural shape or the lateral loading system, become increasingly essential as the building rises in height and slimness. Weight per square foot of floor space is a useful metric for comparing the efficiency of different high-rise buildings that serve the same function and are made of the same material.

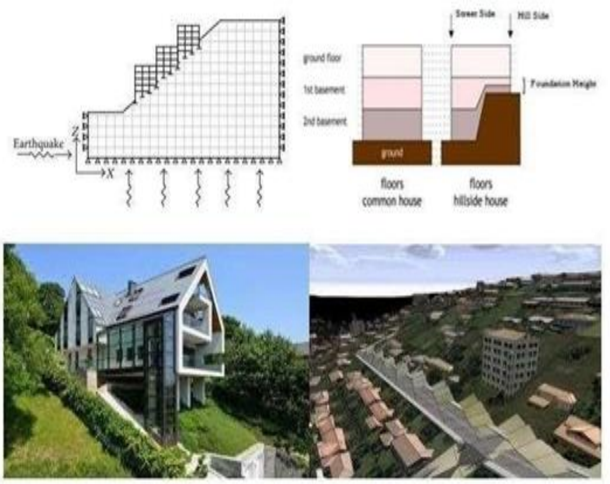

Fig 1. Buildings on sloping ground.

II. OBJECTIVES OF STUDY

- To study the effect of zone on seismic performance of buildings resting on plain ground up to height 81.80 meters.
- To perform the dynamic earthquakes analyzing by using response spectrum method.
- To compare the performance of building on plain ground with shear wall, and without shear wall.
- To compare the performance of building on plain ground in earthquake zone 4 and zone 5.

III. METHODOLOGY

During an earthquake, a building's performance might be negatively impacted if the height of its columns below plinth level varies. As a result, there is a crucial role that must be played in enhancing the seismic resistance of buildings. As a result, an effort is made in just this research to examine horizontal high-rises. The research takes into account models of RCC buildings with a maximum floor count of G+26, all of which are situated on flat terrain. The building's reaction spectrum is analysed by structural engineering software StaadPro V8i (SS4).

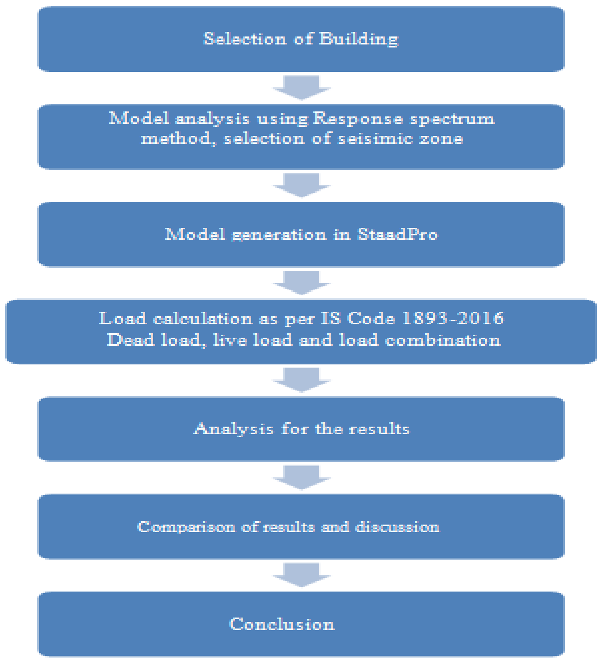

Fig 2. Methodology.

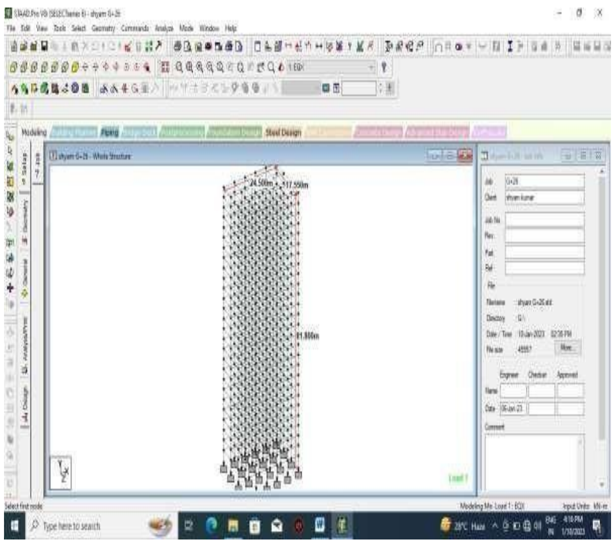

Fig 3. STAAD input with dimensions 3-D view.

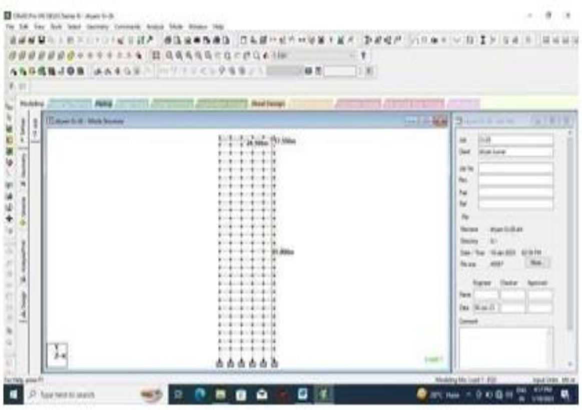

Fig 4. STAAD input with plain dimension.

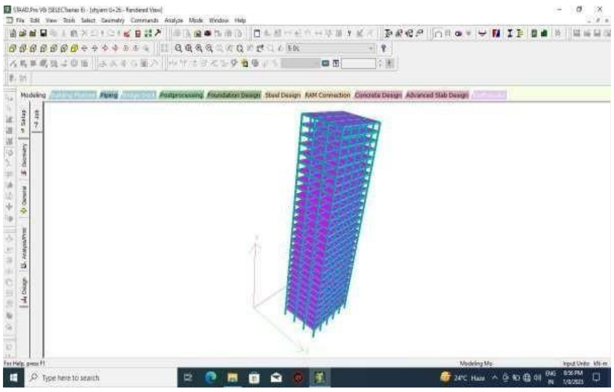

Fig 5. 3D rendering view.

IV. RESULTS AND DISCUSSION

The results of present study are as follows:-

1. Base shear

Table 1. Base shears results.

	Zone = 4	Zone = 5
Models	Base shear (KN)	
Model 1	20012.69	15415.06
Model 2	17731.04	15213.23

From the results obtained from this study it It is clear that the addition of a shear wall to an RCC frame raises the base shear because of the structure's increased lateral stiffness. As a result, not only is the duration of the structure shorter, but the time required for the structure to move laterally is also much diminished. So, it may have been concluded that the addition of shear walls raises the base shear, an effect also evident when shifting from zone 4 to zone.

For zones 4 and 5, the lowest base shear value may be found in model 2 (C-shape), compared to all other shear wall designs.

2. Fundamental time period In Zone IV:

Table 2. Fundamental time period results.

	X	Z
Models	Time period (Sec)	
Model 1	5.23	5.79
Model 2	4.09	4.56

3. Member forces:

The shear forces Moreover, shear walls have the same effect on bending moments in columns as they do in models run on flat ground. Forces exerted on the members, including axial, shear, and bending moments, are displayed Moreover, shear walls have the same effect on bending moments in columns as they do in models running on level ground. Forces exerted on the members, including axial, shear, and bending moments, are displayed.

Table 3. Axial force results.

Model	Zone = 4		Zone = 5	
	Axial force (KN)			
	Max Fx (in kN)	Min Fx (in kN)	Max Fx (in kN)	Min Fx (in kN)
Model 1	1228.99	-6.205	1848.49	-17.77
Model 2	1200.92	-8.205	1740.4	-18.72

Model 1 shows that the strongest axial forces occur in zones 4 and 5.

V. CONCLUSION

From the above discussion following conclusions can be made: Including a shear wall into a structure on flat ground enhances its lateral stiffness, and hence its resistance to shear forces.

Furthermore, the construction time for a building on flat ground is shorter, and the structure is less likely to shift laterally. Adding a shear wall has the same impact as switching the seismic zone from IV to V, hence it can be concluded that this raises the base shear. The model's base shear value is the lowest of all possible shear wall configurations for zones IV and V in buildings situated on flat land.

On plain ground, the shortest feasible period for Mode 2's zone IV applies in cases when Mode 1 is not possible. In model 1, the axial forces in zones IV and V of a structure on a flat site are at their greatest. The minimum axial forces in zones IV and V may be shown in model 2. Model 1 shows the highest shear forces in both zones IV and V. From model 2 shown min shear forces for zone IV. From above observation we select model 2 in zone 4

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