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Analysis of Tower on Building with Setback and Sloping Ground

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ABSTRACT

The structures are fundamentally manufactured on a typical plain ground. these days due to lack of land area, construction has been done on a sloping ground. The mountainous areas are the majority exaggerated due to earthquake activity. High damage experienced by the high rise structure in the mountainous region, as outcome causes harm and breaking up; hence reason of designing towards protection in opposition to natural disasters. The key point is to analyze the seismic task applied by Multi-Storied RC structure on an sloping ground with specific angle 29o. The Multi-Storied building is taken at different position of tower of slope angle. The outcome have been evaluated with the structure taken without slope and with sloping ground 29o angle having on plane ground. Thus the seismic analysis is the part of Dynamic analysis. There are two types of arrangements taken for the study along sloping ground .i.e. set back and step backset back. Hence G+10 RCC building is considered with different location of building with sloping ground with set back and stepback condition for analyzing. The analysis was carried by the Seismic Analysis Method. The whole process and the methods are carried out by IS-1893-2016 .STAAD pro software is used to explore the Response Spectrum Method. All the operations performed are the part of procedure which gives the result that the step back set back building is more suitable than other methods.

Keywords: Seismic activities, inclined ground, High-rise, Slope angles, Seismic analysis method, Step back-Setback, Response Spectrum Method

INTRODUCTION

In today's world expansion of cities and human colonies increasing day by day that is causing our agricultural lands and villages. To prevent unnecessary use of land high-rised buildings plays an important role. It reduces extra land use and cost. Therefore now a day towers are shifted upon buildings to save land from unnecessary construction. Tower companies are using building for towers they can use buildings as rental or permanent basis for towers.

The construction and safety of these towers are main issue for the Engineers therefore to prevent it from earthquake and wind load analysis is required. The analysis can be done by using several software's they are-

1. E- TABS

2. SAP 2000

3. STAAD PRO

4. CATIA

5. REVIT STRUCTURE

Modeling through this software's helps to find strength of the structure against lateral and vertical loads. Analysis result shows the safety of the structure against lateral and vertical loads. If the structure is situated on steep or sloping ground the analysis of the structure is more important.

India is fastest growing economy in the world therefore infrastructure is its basic need. The infrastructure of India is growing faster as it can be. The construction of high-rised buildings increases in India in last few decades.

The idea of rooftop towers increasing rapidly in all over the India. To increase the telecommunication performance and to decrease the land use it is good infrastructure model. It also saves the cost of land by using high-rised buildings.

Due to a trend presented sometimes earlier in our country, generally it is said that the peoples of hilly regions are migrating from hills to adjoining city for occupation and to fulfill their need but now a days the tourism industry have seen a tremendous growth in hilly regions. The proclivity of peoples again leaned towards hilly region whether it may be towards adventure, divine approach, or for enjoyment purpose it may leads to escalate employment, sojourn people to migrate and thus ultimately promotes the construction industry to build more and more building in these areas. Also the decreasing rate of land available for human use leads to move real estate and construction business towards hilly reason where the scope of construction is high. Although the complexities are higher in terms of construction practices in hilly terrain but the scope of land and variable architecture is high.

OBJECTIVE OF THE WORK

Various papers are presented to elucidate the possible construction practices adopted in the hilly terrain to sustain in such kind of topography so as to optimize the structural parameters especially seismic one as they generates havoc which will results in severe loss of mankind and economy. By going through and analyzing several research paper it was determined that studies are conducted on hilly terrain while considering various limitations but two specific sloping terrain are not analyzed simultaneously so far under same seismic constraints. Considering the aforementioned problem statement further research work is set out with proposed conclusive outcomes specified below:

To explore the seismic response in the sloping terrain G+10 storied building framed with different configurations comprising building rested on sloping terrain having step-back type configuration, setback wit step-back type configuration and building without and slope.

Sloping terrain situated of 29˚ with telecommunication tower on roof to analyze the buildings located on zone III and rested on medium soil.

All the models are investigated for various seismic parameters like axial force, shear force, bending moment, base shear, story displacement, story drift, time period and mass participation factors and torsion moment in both direction lateral and longitudinal.

And finally on the basis of comparative analysis of above parameters most optimum case is to decide with the help of Staad pro software.

Result:-

Modeling of structure

The explanation of building such as seismic load, dead load, live load, shape and size of column, beam and plate or slab, and additional components are listed below in Table 4.1.Since by using STAAD pro software a range of properties are used.

Table 1: Dimensions of different components of building

Building configuration	G+10
No. of bays in X direction	5
No. of bays in Z direction	5
Height of building	43.26 m
Dimensions of building	15m X 15m
Size of beam	0.45 X 0.45
Size of column	0.40 X 0.30
Concrete and Steel Grade	M 30 & FE415
Earthquake parameters	Zone III with RF 4 & 5% damping ratio
Period in X & Z direction	1.00527 & 1.00527 for both direction
Dead load for floor with waterproofing	2KN/m2
Live load for floor and roof	2.9KN/m2 & 1 KN/m2

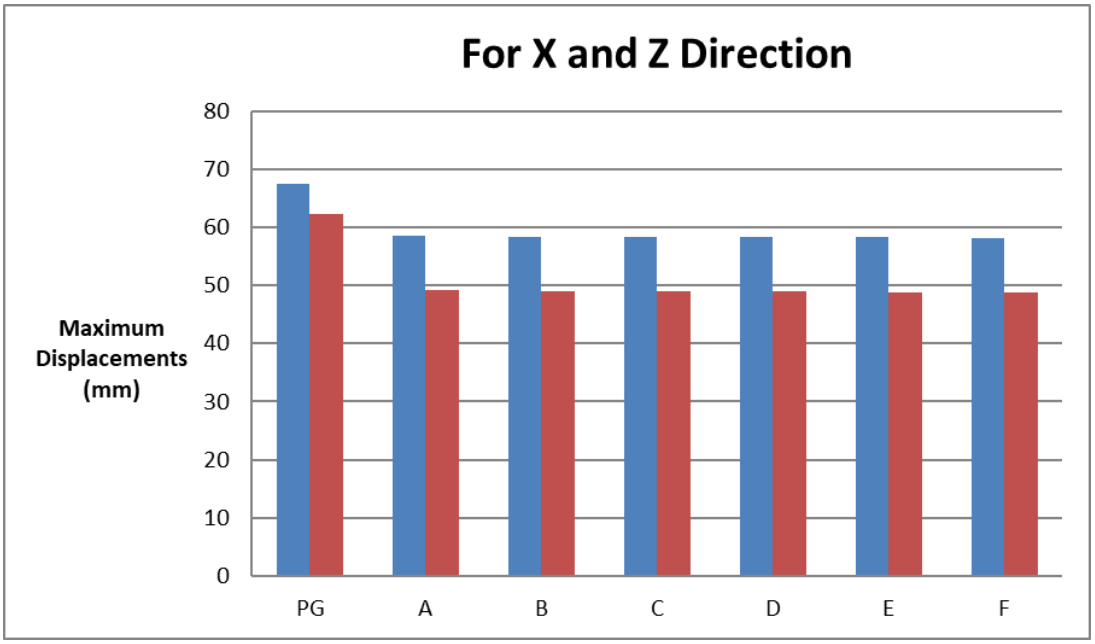
Types of models used for analysis of structure

Diverse types of cases are measured in G+10 storey building of different type of ground; Different types of models are specified below:-

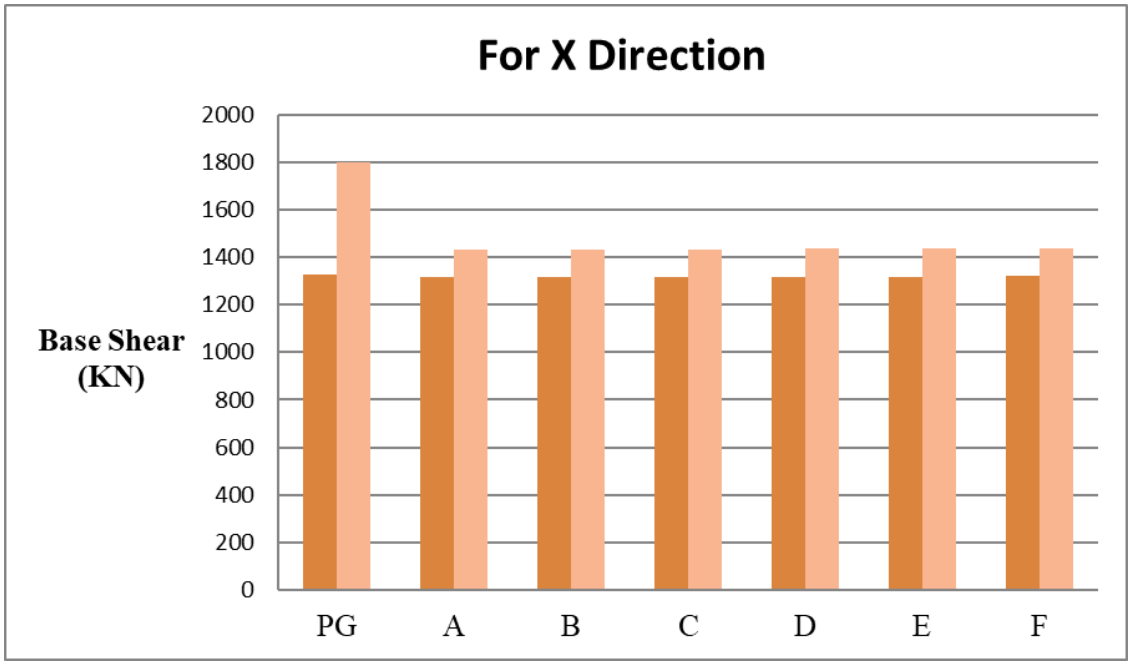
Table 2: Details of various building cases

Case 1	ZONE III	G+10 Multi Storey regular building on plane ground
Case 2		G+10 Multi Storey regular set back building with tower location 1
Case 3		G+10 Multi Storey regular set back building with tower location 2
Case 4		G+10 Multi Storey regular set back building with tower location 3
Case 5		G+10 Multi Storey regular set back building with tower location 4
Case 6		G+10 Multi Storey regular set back building with tower location 5
Case 7		G+10 Multi Storey regular set back building with tower location 6

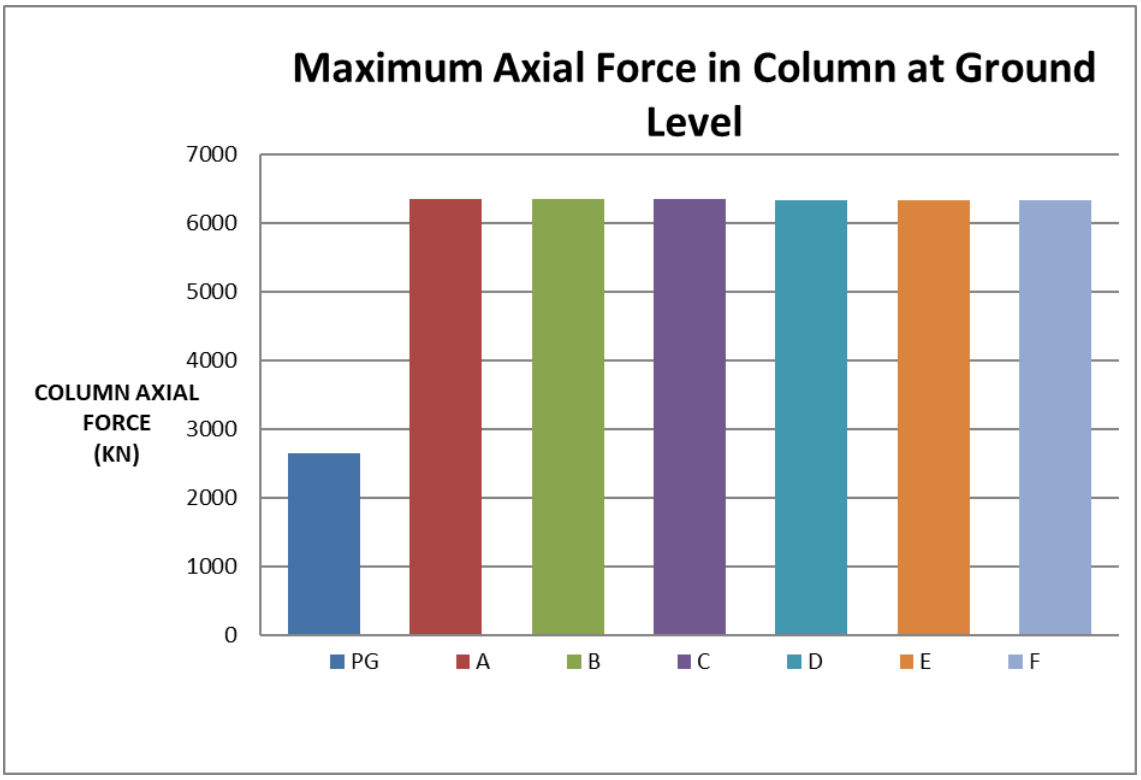
Case 8	G+10 Multi Storey regular Step back set back building with tower location 1
Case 9	G+10 Multi Storey regular Step back set back building with tower location 2
Case 10	G+10 Multi Storey regular Step back set back building with tower location 3
Case 11	G+10 Multi Storey regular Step back set back building with tower location 4
Case 12	G+10 Multi Storey regular Step back set back building with tower location 5
Case 13	G+10 Multi Storey regular Step back set back building with tower location 6



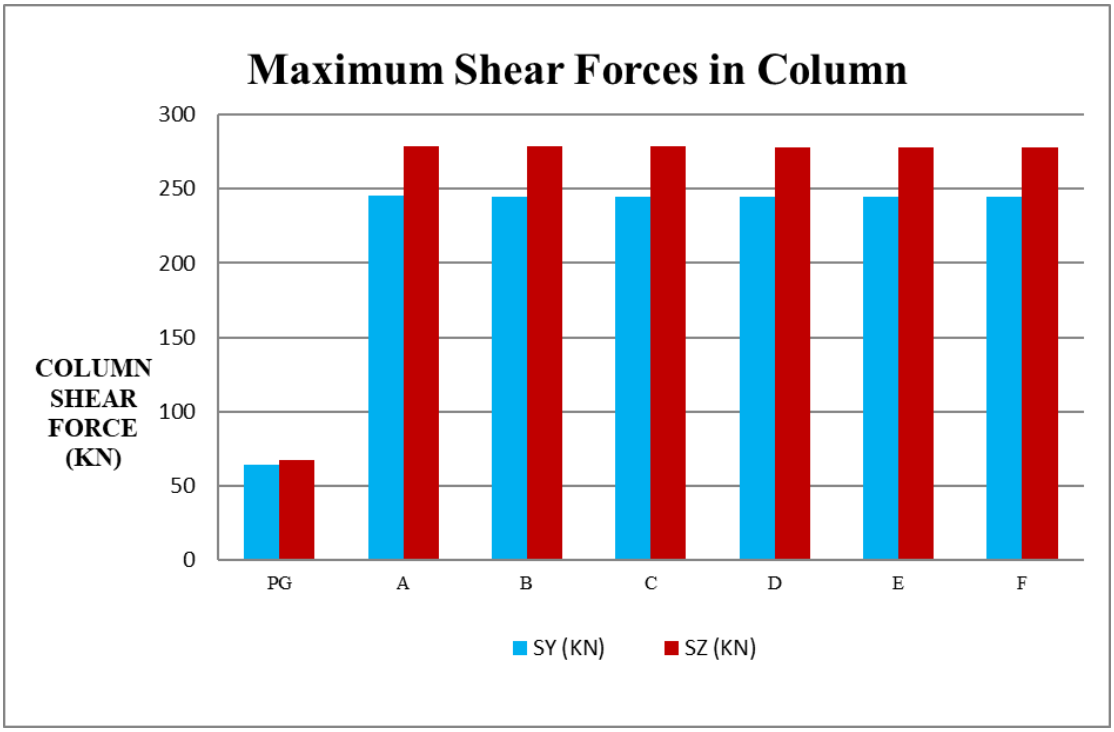
As the study shows location F is perform well among all the cases in the displacement for both X and Z direction.



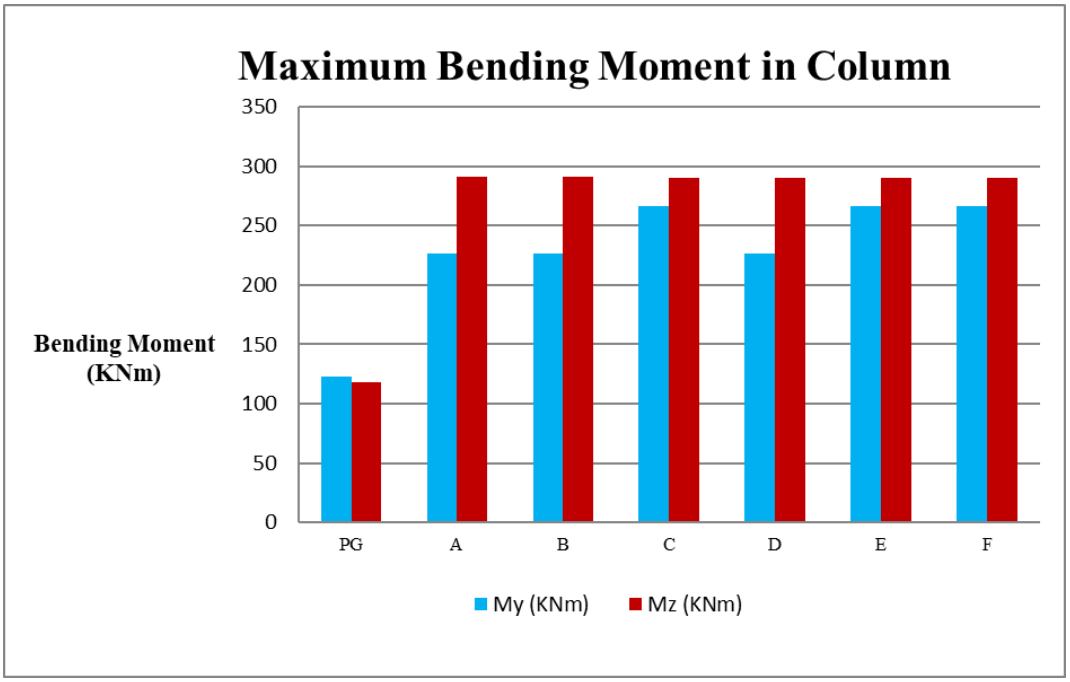
On comparing base shear for X and Z direction LOCATION A is performing very well than other cases



In the study of Axial Force factor Location F is performing well than other location.



Above study of column shear force in both direction locations F perform well among all location.



Above study of column Bending Moment in both direction locations F perform well among all location

Conclusions are carried out:

As we analysis about set back building and step back set back building with plain ground with 14 diverse locations of tower and here are such location of tower with set back and step back set back building which gives the a range of result concerning every position of tower in the building. In term of mentioned location subsequent outcome are obtained from this comparative analysis.

On analyzing the setback six building with tower ,different location condition with plain ground has been concluded that the Torsional Moment in beams along X direction location F is very efficient and direction for Z direction in Torsional Moment in beams location F is very efficient. Overall analysis said that the most efficient case for Set Back as well as Step Back set back building with tower, different loation for the above study is location F. It is consider as the location F best location of among all of these.

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