“ANALYSIS OF A MULTI STORIED BUILDING SITUATED IN SEISMIC ZONE V AS PER IS 1893-2016 ON SLOPING GROUND”

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Abstract: The seismic study of a multi-story building located in seismic zone V according to IS 1893-2016 on sloping land with angle of inclination 0°, 10°, and 20° on soft, medium, and hard strata is investigated in the current dissertation work. In accordance with IS 1893-2016, the seismic analysis of a multi-story building built on filled slope ground (level ground) with soft, medium, and hard strata is also studied. The seismic reactions of the aforementioned structures, including horizontal displacement, bending moment, shear force, torsion, and storey drift, are examined in order to understand their seismic behaviour. These buildings have also had their costs analysed. Using the software Etabs, the multi-story building’s seismic analysis is conducted.

Keywords - seismic, multi-story, seismic zone, sloping, structures, horizontal.

I. INTRODUCTION
Indian tectonic plate being one of the most active tectonic plates, India has faced a number of deadly earthquakes that left thousands of people dying each time. The Bureau of Indian standards (BIS) has been doing a considerable effort to mitigate the hazards due to these earthquakes. Scientists in India have concentrated on bringing up a code of practice for seismic resistant design (IS 1893), which gives guidelines to engineers on the amount of forces to be accounted in the seismic regions. Development of seismic zoning map has been a subject of research in India for the past 40 years. Seismic zoning map is a map that divides entire country into different regions according to the earthquake potential in those regions.

II. SLOPING GROUND
The scarcity of plain land in hilly areas, majority of the buildings is constructed on the hill slopes with irregular structural configuration having foundations at different levels. Such buildings pose special structural and constructional problems. The construction of building on a sloping ground has to face severe earthquakes. The impact of step-like incline geology on buildings has not been completely inspected previously. Actually, this type of surface geology has drawn minimal consideration among researchers, when contrasted with slopes and ravines. One conceivable reason is the non-symmetric geometry of step-like inclines, which entangles expository arrangements and supports for the most part site particular numerical reenactments as shown in Figure 1.2. The seismic failure of building on these sloping grounds is a main challenge for the structural designers. In Sikkim earthquake, 2011 in India exposed the RC frame buildings on hill slopes to ground shaking.
III LITERATURE SURVEY

Chauhan and Banerjee (2021) studied G+10 RCC Step back building having each storey of height 3.6m with a horizontal angle of inclination 20°, 30°, 40°, and 45° on the sloping ground. They analyzed the building in seismic zone V by Response Spectrum method for the purpose of commercial with two of the top storey to be used for setup of machinery equipment which induces as Mass irregularity and ground to top of the storey at the edge of the planned building used as an opening for the purpose of natural lighting and stair which induces as Diaphragm irregularity. The analysis and modeling of the Stepback building are carried out by ETABS ver. 18.0.2 software as per IS 1893:2016. They compared the building based on their dynamic response properties like mode Period, Base Shear, Story deflection, Story drift, and story shear and also find out the frame vulnerability in irregularities of structure on the sloping ground.

IV STRUCTURAL METHODS OF ANALYSIS

Once the structural model has been selected, it is possible to perform analysis to determine the seismically induced forces in the structures. There are different types of analysis which provide different degree of accuracy.

The analysis procedure can be categorized on the basis of three factors:

(i) The types of externally applied loads,
(ii) The behavior of structural materials,
(iii) The types of structural model selected.

V FIGURES AND TABLES

Figure 1. Plan view of RC G+10 building

Figure 2. 3-D rendered view of RC G+10 building
### Table 3.3 RCC structure member size

<table>
<thead>
<tr>
<th>Member Size</th>
<th>RCC Column</th>
<th>RCC Beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>foundation to ground floor</td>
<td>0.85 m × 0.85 m</td>
<td>main beam 0.3 m × 0.6 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>secondary beam -0.3X0.53m</td>
</tr>
<tr>
<td>ground floor to 5th floor</td>
<td>0.85 m × 0.85 m</td>
<td>main beam 0.3 m × 0.53 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>secondary beam 0.3 m × 0.45 m</td>
</tr>
<tr>
<td>6th floor to 8th floor</td>
<td>0.7 m × 0.7 m</td>
<td>main beam 0.3 m × 0.53 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>secondary beam 0.3 m × 0.45 m</td>
</tr>
<tr>
<td>9th floor to 10th floor</td>
<td>0.53 m × 0.53 m</td>
<td>main beam 0.3 m × 0.45 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>secondary beam 0.3 m × 0.45 m</td>
</tr>
<tr>
<td>stairs cabin</td>
<td>0.53 m × 0.53 m</td>
<td>main beam 0.3 m × 0.45 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>secondary beam 0.3 m × 0.45 m</td>
</tr>
</tbody>
</table>

Graph: 1. Maximum bending moment (kNm) in medium soil
VI. CONCLUSIONS

From the present study, it can be concluded that hard soil, plain ground is effective and best. Soft soil is worst, medium soil is second best and hard soil is best because it provide least displacement and forces developed in the building under seismic forces. In case of different inclination of ground (0°, 10° and 20°) among all 0° is best, as it provide better stability due to plain ground and also reduces the effect of short columns and variation in stiffness.

VII. ACKNOWLEDGMENT

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VIII. REFERENCES