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ANALYSIS OF MULTISTORIED RCC BUILDING ON A SLOPING GROUND AND FLAT GROUND

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***Abstract* :**

India has track record of catastrophic earthquakes, at various regions, which left behind loss of many lives and heavy destruction to property and economy. Analysis of buildings in hill region is somewhat different than the buildings on leveled ground, since the column of the hill building rests at different levels on the slope. Generally buildings may be failed by bending moments, shear forces acting on members of the building. By keeping these failures in mind, we designed beams, columns, footings by considering maximum loads on members. For loads calculation, substitute frame method is used for reducing the complexity of calculations and saving time. This total G +3 residential building analysis with only manual calculations based on values here taken from the standard code books (IS 456:2000, IS 1893:2016, IS 875:part1 & 2)

Keywords—sloping ground, seismic analysis, base shear, base moment, displacement, axial force, and bending moment

1. INTRODUCTION

Earthquake is the most disastrous due to its unpredictability and huge power of devastation. Earthquakes themselves do not kill people, rather the colossal loss of human lives and properties occur due to the destruction of structures. Building structures collapse during severe earthquakes, and cause direct loss of human lives. The hilly area is more prone to seismic activity e.g. northeast region of India. In this hilly regions, traditionally material like, the adobe, brunt brick, stone masonry and dressed stone masonry, timber reinforced concrete, bamboo, etc. are used which is locally available, is used for the construction of houses. The scarcity of plain ground in hilly areas compels construction activity on sloping ground resulting in various important buildings. Hill buildings constructed in masonry with mud mortar/cement mortar without conforming to seismic codal provisions have proved unsafe and, resulted in loss of life and property when subjected to earthquake ground motions. In this region the construction of multistory RC framed buildings on hill slopes has a popular and pressing demand, due to its economic growth and rapid urbanization. This growth in construction activity is adding to tremendous increase in population density. Also there is scarcity of ground in hilly regions so reinforced cement concrete buildings such as hospital buildings, residential buildings are constructed in the sloping areas, hence construction of multistoried R.C.

2. SCOPE & OBJECTIVE

- To analyze and compare the physical constraints mainly storey displacement for building on sloping ground with the building on flat ground in ZONE IV.
- To analyze and compare the base shear for both the buildings i.e building rested on sloping surface and on flat surface in ZONE IV.

- To study and compare the effect of earthquake on both the buildings in ZONE IV.

3. METHODOLOGY

This present work deals with study of behavior of sloping ground building different inclination (0o, 10o, 15o, 30o) under earthquake forces. The comparison of sloping ground and flat ground building under seismic forces is done. Here G+ 3 storey is taken and same live load is applied in three the buildings for its behavior and comparison. The framed buildings are subjected to vibrations because of earthquake and therefore seismic analysis is essential for these building frames. The fixed base system is analyzed by employing in three building frames in seismic zone IV by means of STAAD Pro.Software.

3.1 STEP FOR COMPARISION

Comparisons of results in terms of horizontal reaction,

bending moments, axial force. Following steps are adopted in this study.

Step-1 Selection of building geometry and Seismic zone: The behavior of three the models is studied for seismic zone IV of India as per IS code 1893 (Part 1):2002 for which zone factor (Z) is 0.24.

Step-2 Formation of load combination Types of Primary Loads and Load Combinations: The structural systems are subjected to Primary Load Cases as per IS 875:1987 and IS 1893:2002.Six primary load case and thirteen load combinations used for analysis.

Step-3 Modelling of building frames using STADD Pro. Software.

Step-4 Analysis of three the building frames are done under seismic zone IV for each load combination.

Step-5 Comparative study of results in terms of bending moments and horizontal force.

4. MODELLING

STADD Pro. Software is used in modeling of building frames. STADD stands for structural analysis and design

Program and it is general purpose software for performing the analysis and design of a wide variety of structures. The basic activities which are to be carried out to achieve this goal:

a. Geometry of the structure.

b. Providing material and member properties.

c. Applying load and support condition.

The data of various structural elements and the loadings considered of the building is as follows:

- No. of floors = 04
- Length of building =10.25m
- Width of building =10.52m
- Height of building =13.5m
- Size of column =0.23*0.45m
- Size of beam =0.23*0.38m
- External plaster =0.015
- Internal plaster =0.012
- Live load =3Kn/m^2
- Zone factor =0.24(Zone IV)
- Importance factor I = 1
- Response spectrum factor R =3

4.1 Plan and Elevation Of G+3 Building On Flat And Sloped Ground Building.

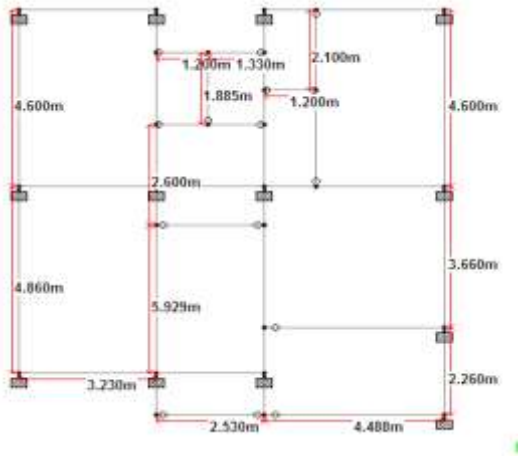

Fig . Plan of residential building

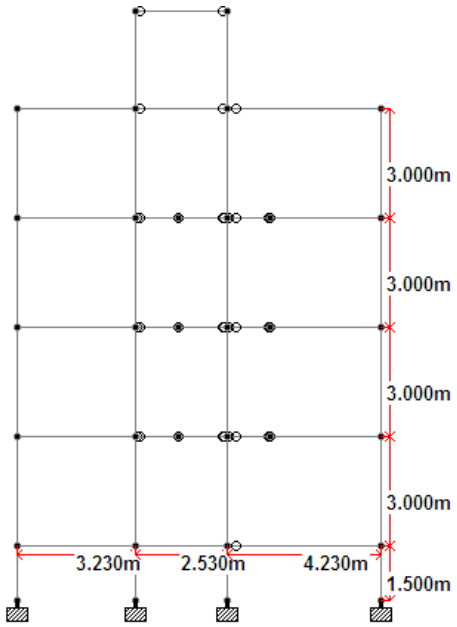

Fig . Elevation of residential building

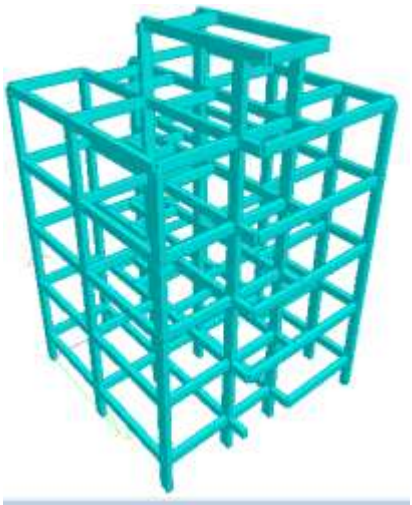

Fig . Structural model of building

5. LITERATURE REVIEW

1. Pawan Pawar and Asst. prof. Deepa Telang Perform an comparative study on seismic analysis of multistoried bulding resting on a sloping ground and flat ground. This project report comparies of seismic analysis of a RC building with symmetrical plan. Building G+8 is analyse using response spectrum method on various combination of shear wall and different position of building on same slope of ground with seismic zone III and it is analysed by using STADD Pro. V8i. In this paper angle of ground is taken as 170 and kept same for all models. They are compare five parameters i.e. base shear, base moment, absolute displacement, axial fore and bending moment.

2. Sujit Kumar ,Dr. Vivek Garg, Dr. Abhay Sharma has perform effect of sloping ground on structural performance of RCC building under seismic load . In this paper work deals with study of behavior of sloping ground building frames considering different inclination (7.5o, 15o) under earthquake forces. The comparison of sloping ground and plane ground building under seismic forces is done. Here G+4 storey is taken and same live load is applied in three the buildings for its behavior and comparison. The result of various analyses for different ground slopes are presented and a comparative study between result of different slopes and plane ground is made to analysis of sloping ground on structural forces. In this work horizontal reaction and bending moment in footing of structure , bending moment in columns and are compared for different ground slopes under different seismic load.

3. Roser J. Robert and Ranjana M. Ghate has perform Seismic Analysis of Multistoried RCC Building on Sloping Ground. The present work is focused on the comparison of the behavior of the building rested on sloped surface and on flat surface with same intensity of seismic load on both the buildings. The parameters which are mainly focused on are storey displacement and base shear. In this study the storey displacements for both the buildings is been evaluated in +X and –X direction as well as in +Z and –Z direction. Similarly the base shear is been calculated and compared for both the buildings rested on sloped surface and flat surface under the same seismic loading.

6.CONCLUSION

Based upon following literature review it can be concluded

- Critical bending moment in the column increases with increasing slope of ground.
- The critical horizontal forces of footing increases significantly with increases in ground slope.
- As number of storey increases storey displacement decreases both in RCC building on slope surface and on flat surface
- The building rested on sloped surface is found to be more vulnerable during seismic effect as compared to building rested on flat surface.

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