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Design And Analysis of Multi Story Building On Sloping Ground And Flat Ground By Using ETABS

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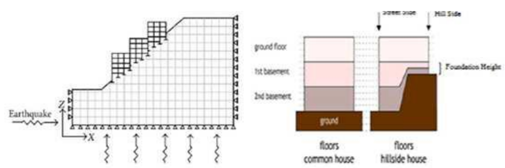
Abstract- In a creating nation like India there is a shortage of land because of urbanization and industrialization, which drove the path for development of skyscraper multi story structures on uneven areas. Structures built on bumpy zones are unique in relation to the structures developed on level grounds on account of their inconsistency and unsymmetrical structure in vertical and even plane. Additionally, these structures on uneven zones are considerably more inclined to quake powers. The fundamental goal of the present work is to contemplate the conduct of the structures on slanting ground and level ground. The structures laying on slope regions must be designed uniquely in contrast to level ground. Slope structures are not the same as those in fields. They are exceptionally unpredictable and unsymmetrical in even and vertical planes, and torsionally coupled and consequently helpless to disjoin harm when influenced by seismic tremor.

In this work an endeavor has been made to examine the conduct of the sporadic Multi story working with two diverse inclining edges 1400, 1200 and the examination was made with the level ground by considering it on various quake zones like zone III, IV and V. The correlation is made for level ground fabricating and inclined ground building. The models are readied utilizing ETABS auxiliary investigation programming. Investigation is finished by utilizing Response range examination. The consequences of the examination i.e., relocation, minutes, story shear and story floats are classified and contemplated.

I. INTRODUCTION

Seismic load is the most deplorable and flighty marvel of nature. At the point when a structure is subjected to seismic powers it doesn't make misfortune human lives specifically however because of the harm cause to the structures that prompts the fall of the building and henceforth to the inhabitants and the property. Structure subjected to seismic/quake powers are constantly helpless against harm and on the off chance that it happens on a slanted working as on slopes which is at some tendency to the ground the odds of harm builds substantially more because of expanded horizontal powers on short segments on tough side and along these lines prompts the arrangement of plastic pivots. Structures on inclines contrast from those on fields since they are unpredictable on a level plane and additionally vertically.

As of late Sikkim (2011), Doda (2013) and Nepal seismic tremor (2015) caused gigantic demolition. In this district there is a request of development of multistory RC confined structures because of the quick urbanization and increment in monetary development and in this way increment in populace thickness. Because of the shortage of the plain territory in this district there is a commitment of the development of the structures on the slanting ground. In exhibit work, atenstoried confined working with a tendency of 120°and 140° to the ground subjected to sinusoidal ground movement is displayed with a test by performing Response range investigation in auxiliary examination and outline programming (ETABS V9.7.4).



Buildings on sloping ground

Objective of the study

The accompanying are the principle goals of the task

1. To investigation the seismic conduct of multi-story working by utilizing IS 1893:2002
2. To contrast the multi-story structures and incline of 1200 and 1400 with level ground.
3. To examination the seismic conduct of multi-story structures in Zone III, Zone IV and Zone V according to IS 1893:2002.
4. To analyze the consequences of Story Drift, Shear compel, bowing minute, Building torsion of structures with incline of 1200 and 1400.
5. To examination the structures in ETABS V9.7.4 in Response range investigation.

II. LITERATURE REVIEW

P. Manjunath and Yogeendra R. Holebsgilu

In this examination 10 storied 3D demonstrate with 4 bayous in Y heading and 6 straights in X bearing. The slant of the ground is taken between 0o to 30o. ETABS 2015 programming is utilized to break down and plan the model for various soil compose and for the seismic zone V. They inferred that diminishing in seismic weight is seen when the incline at the base is expanded and the execution of the building is expanded when the firmness of the dirt is more.

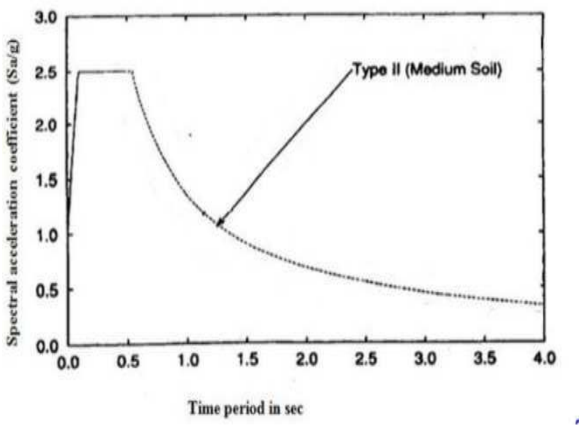
Sandip Doijad and Surekha Bhalchandra (2015)

In this paper, they considered the seismic conduct of RC structures with various arrangement of Shear dividers on plain and slanting ground. They considered G+8 story RCC working for investigation. The point of the slanting ground considered for the examination alongside the leveled ground are 9o, 18o and 27o. The examination was completed utilizing SAP2000 programming for Zone II and for medium soil.

III. METHODOLOGY

Response spectrum method

This examination is completed by the code IS 1893-2002 (part1). Here kind of soil, seismic zone factor ought to be entered from IS 1893-2002 (part1). The standard reaction spectra for sort of soil considered is connected to working for the investigation in ETABS 2013 programming. Following chart demonstrates the standard reaction range for medium soil compose and that can be given as day and age versus ghastly speeding up coefficient (Sa/g).



Response spectrum for medium soil type for 5% damping

C. *In this we need to figure the size of powers every which way i.e. X, Y and Z and after that see the consequences for the building. Mix techniques incorporate the accompanying:*

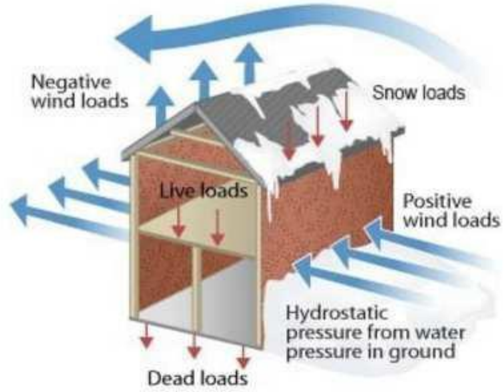
· *absolute* **-** *crest esteems are included*

· *square base of the total of the squares (SRSS)*

· *complete quadratic mix (CQC)* **-** *a strategy that is a change on SRSS for firmly dispersed modes*

D. *Different types of loads acting on the structure*

The types of loads following up on structures for structures and different structures can be comprehensively named vertical loads, flat loads and longitudinal loads. The vertical burdens comprise of dead loads, live load. The even loads contains wind load and quake load.



Loads acting on a building

Types of loads acting on the structure are:

a) Dead loads
b) Imposed loads
c) Wind loads
d) Snow loads
e) Earthquake loads
f) Special loads

IV. MODELING OF BUILDING

Problem statement:

In the present study, analysis of G+10 multi-story building in Zone III, Zone IV, Zone V seismic zones is carried out.3D model is prepared for G+10 multi-story building is in ETABS.

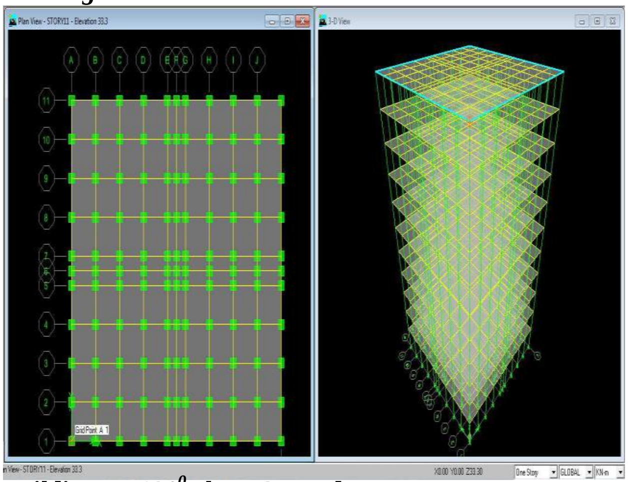
Basic parameters considered for the analysis are

1. Utility of building	: Residential building
2. Number of stories	: G+10
3. Shape of building	: Rectangular
4. Slopes of the building	: 120^0, 140^0
5. Geometric details	
a. Ground floor	: 3.3m
b. floor to floor height	: 3m
6. Material details	
a. Concrete Grade	: M40 (COLUMNS AND BEAMS)

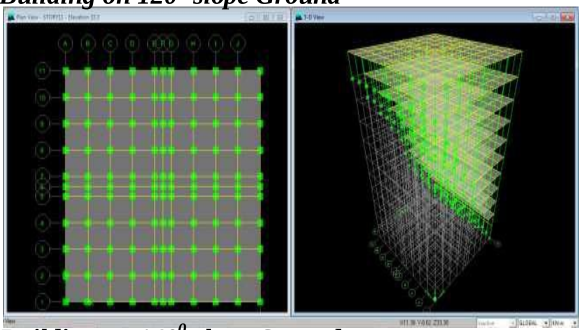
b. All Steel Grades : HYSD reinforcement of Grade Fe415
c. Bearing Capacity of Soil : 200 KN/m^2
7. Type Of Construction : R.C.C framed structure
8. Column : 0.5m X 0.5m
9. Beams : 0.35m X 0.5m
Slab : 0.150m

Models in Etabs v 9.7.4

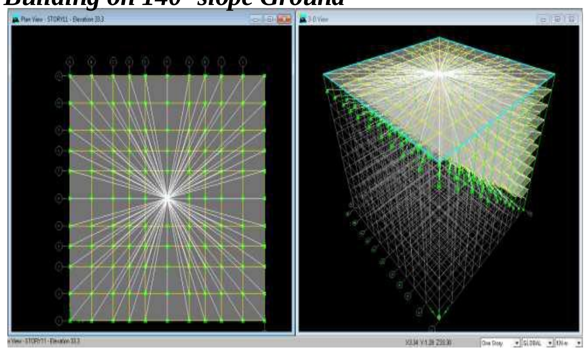
Building on Flat Ground



Building on 120^0 slope Ground



Building on 140^0 slope Ground

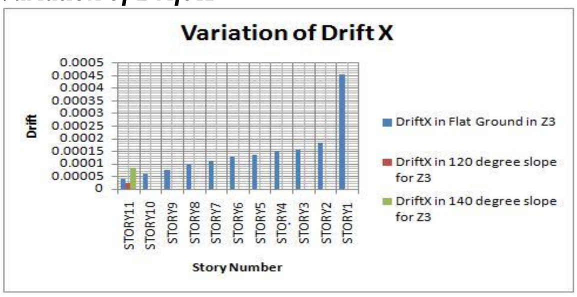


V. RESULTS AND ANALYSIS

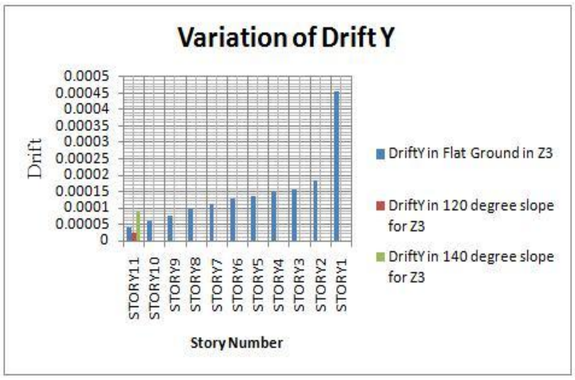
Zone III

Drift

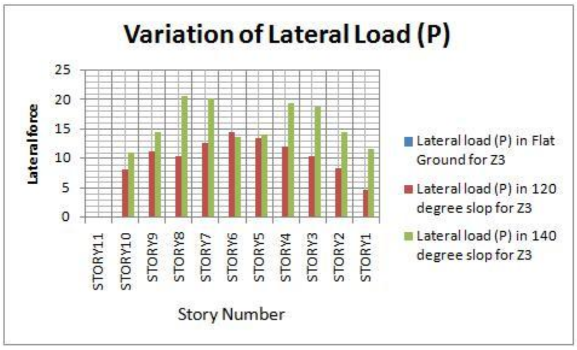
Variation of Drift X



Variation of Drift Y

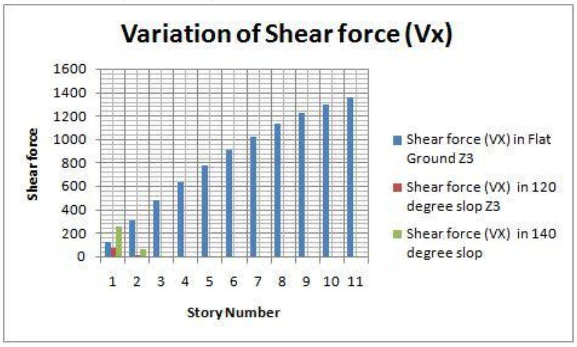


Lateral Load

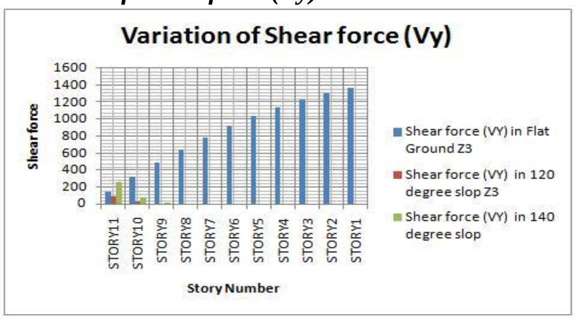


Shear force

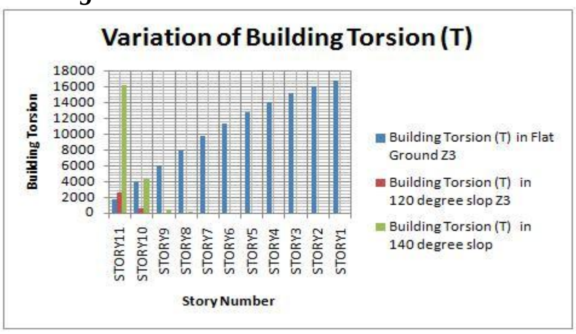
Variation of Shear force (Vx)



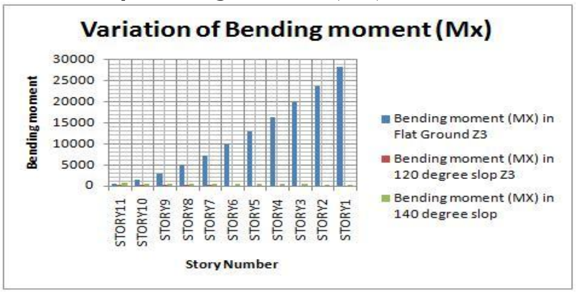
Variation of Shear force (Vy)



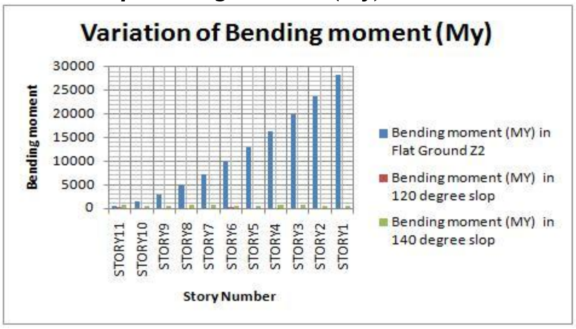
Building Torsion



Variation of Bending moment (Mx)



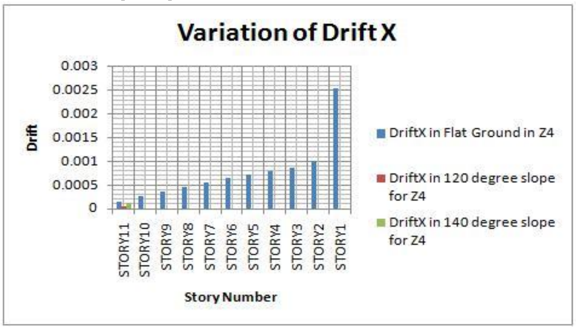
Variation of Bending moment (My)



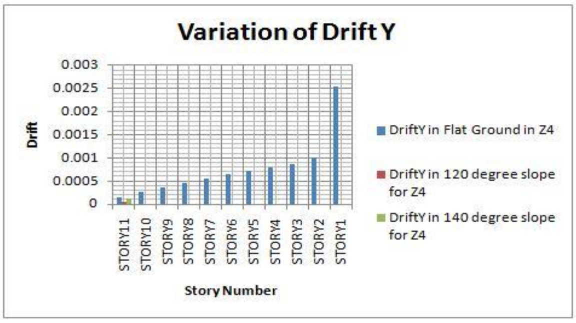
Zone IV

Drift

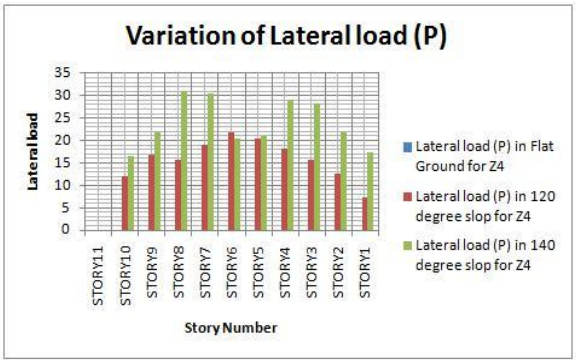
Variation of drift x



Variation of drift y

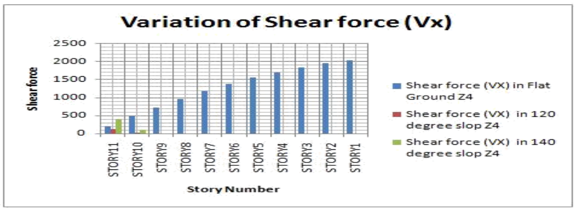


Variation of Lateral load

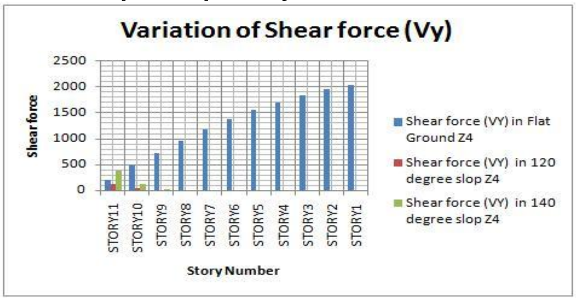


Shear force

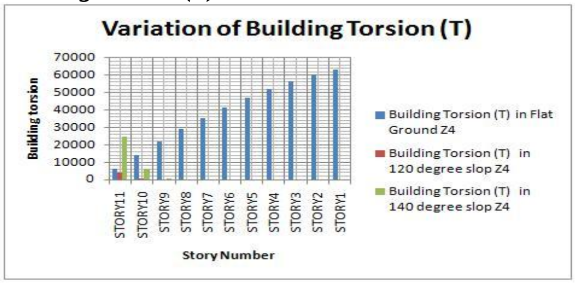
Variation of shear force vx



Variation of shear force Vy

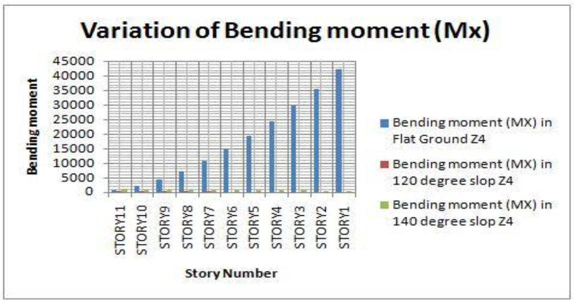


Building torsion (T)

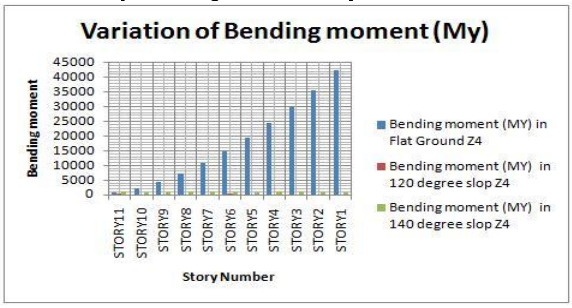


Bending moment

Variation of bending moment Mx

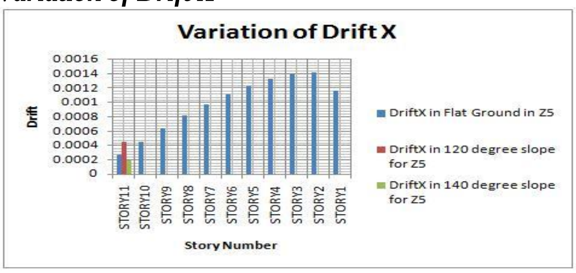


Variation of bending moment My

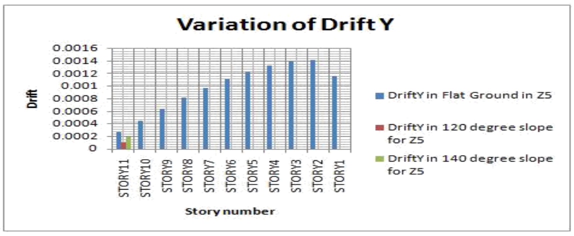


Zone V

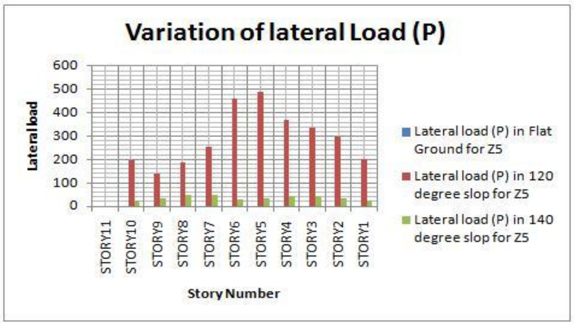
Variation of Drift X



Variation of Drift Y

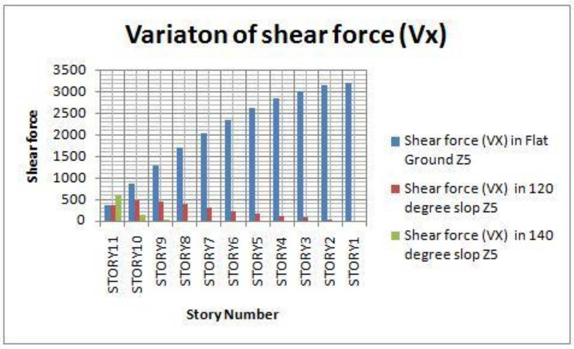


Lateral load

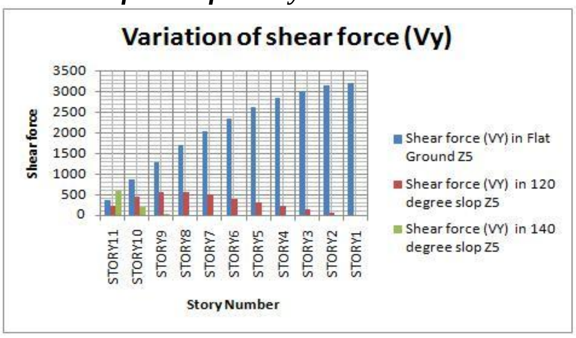


Shear Force

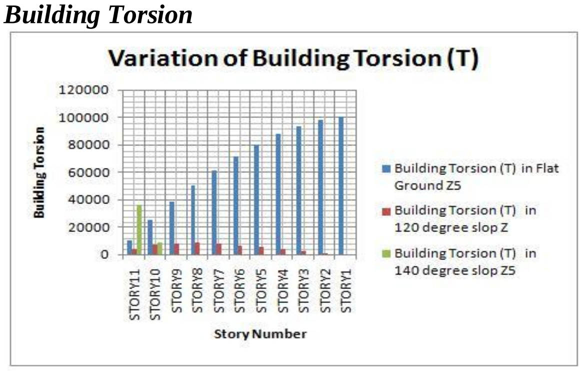
Variation of Shear force Vx



Variation of Shear force Vy

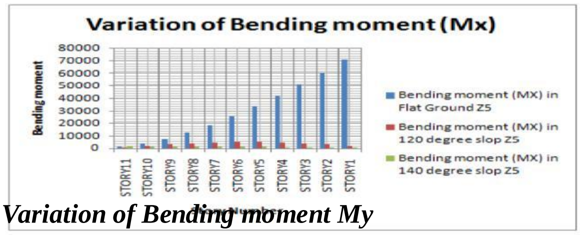


Building Torsion

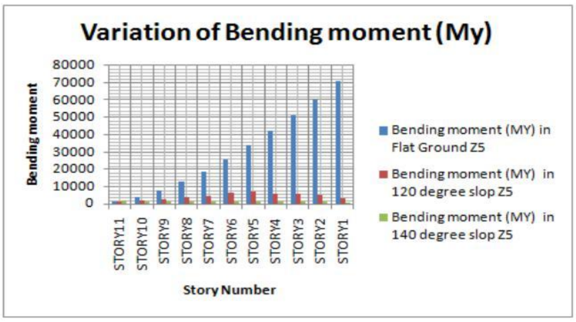


Bending moment

Variation of Bending Mx



Variation of Bending moment My



VI **CONCLUSIONS**

From the above study the following conclusions were made

1. Earthquake is caused when it is subjected to the ground motion and due to which structures suffers damage and to take care of such effects it is important to know the properties of earthquake and predicts its possible response which can incur on the buildings. These properties are base shear, maximum storey displacement.
2. The values of Drift in both X and Y-Direction are found maximum for Flat ground in Zone III, Zone IV, Zone V. from this it was conformed that sloping buildings are more earth quake resistant than flat buildings.
3. The value of Shear force, Bending moment, Building torsion was found to be higher values for the Flat slop building than sloping buildings. Due to presents of slop the buildings are more stable by providing slop.
4. The analysis and design of Sloping ground building with 120^0 and 140^0 slope was done by using ETABS V9.7.4 Software.
5. The number of modes considered in the analysis is satisfying the codal provisions. The modal mass participation of the sloped frame model are decreasing for the first mode and increasing for the second mode with the increase in slope angle.
6. The shear of all the buildings are higher for flat ground building than sloping ground building their distribution on columns of ground storey is such that the short column attracts the majority (75% approx.) of the shear force which leads to plastic hinge formation on the short column and are vulnerable to damage. Proper design criteria should be applied to avoid formation of plastic hinge.
7. On plan ground, setback building attract less action forces as comparing with other configurations on

sloping ground which make it more stable and it would not suffer more damages due to the shear action.

8. On sloping ground set-step back building attract less action forces as comparing with step back building but if the cutting cost of sloping ground is with acceptable limits then setback building may be preferred.
9. Also by observing the graphs we can conclude that for sloped ground building the effect of earthquake is low when compared to flat ground building.

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