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COMPARATIVE STUDYOF SEISMIC ANALYSIS FOR DIFFERENT BUILDING CONFIGURATION ON SLOPED GROUND

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ABSTRACT

The biggest challenge of a structural engineering is to design a seismic resistance building on a sloped ground for zone V. they building is face different earthquake shocks. Then compare normal and sloped building is different analysis process. To apply BHUJ earthquake time period and carried by base shear, shear force, axial force bending moment is very difficult in a different member, in this study the bottom column of the building like 30 storey analysis for 25-degree, 32 degree and 37-degree sloped ground for setback building and step back building. Dynamic analysis will be carried by SAP 2000 software.

Keywords*: sloping ground, time period.*

I. INTRODUCTION

Earthquake is the most disastrous due to its unpredictability and huge power of devastation. Earthquakes themselves do not kill people; it is due to the destruction of structures. Building structures collapse during severe earthquakes, and cause direct loss of human lives. The scarcity of plain ground in hilly regions leads to construction of buildings on a sloping ground. The buildings constructed in the hilly area are highly asymmetric in plan as well as elevation. Behaviour of building on a sloping ground is different from building on a plain ground. The buildings constructed in hilly area are subjected to severe earthquake. In India most of the hilly area is lying in severe earthquake zone. One of the biggest challenges of a Structural engineer is to design a seismic resistant building resting on a sloping ground. Response Spectrum Analysis method is because, forms of damping-which are reasonable models for many buildings-the responses in each natural mode of vibration can be computed independently of the others, and the modal responses can be computed independently of the others, and the modal responses can be combined to determine the total response. The time history analysis (THA) technique represents the most sophisticated method of dynamic analysis for buildings. In this method, the mathematical model of the building is subjected to accelerations from earthquake records that represent the expected earthquake at the base of structure. The method consists a systematic direct integration over a time interval; the equation of motion is solved with the displacements, velocities, and accelerations of the previous step serving as initial functions.

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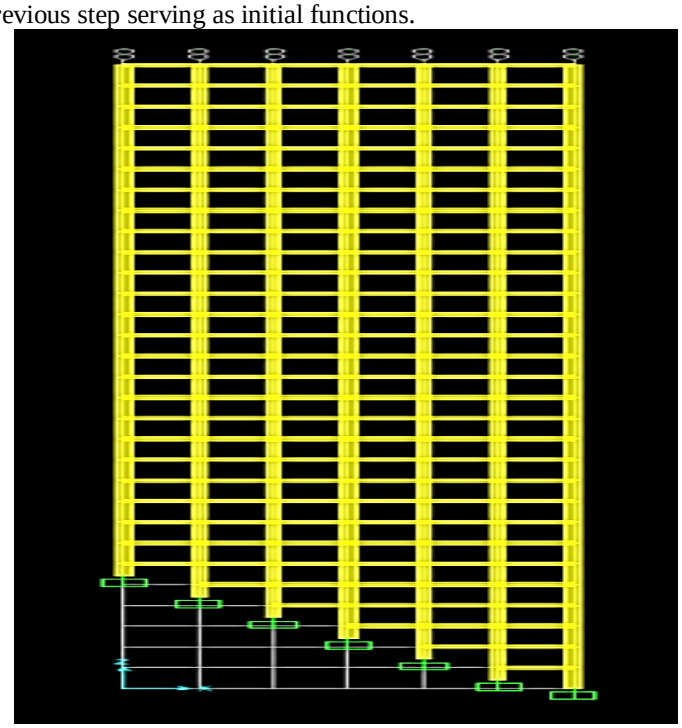

Figure 1: 30 storey set back building

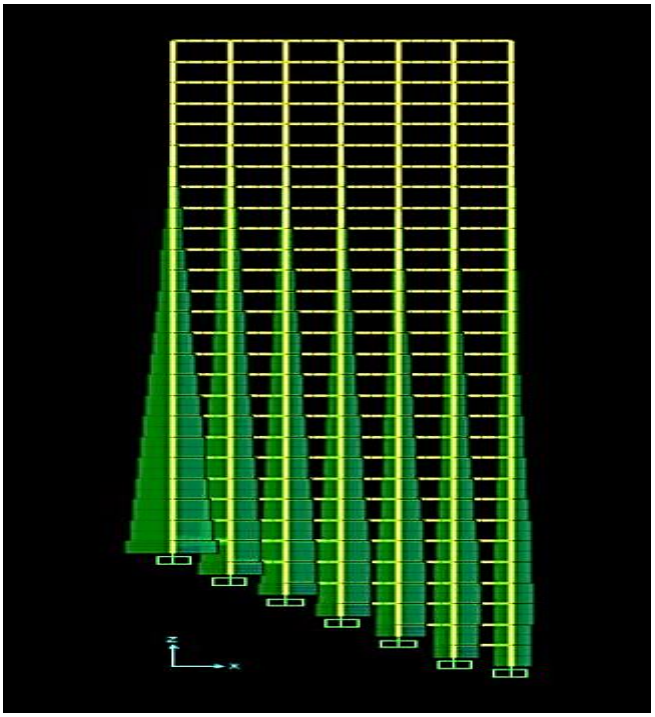

Figure 2: axial forcef 30 storey set back building

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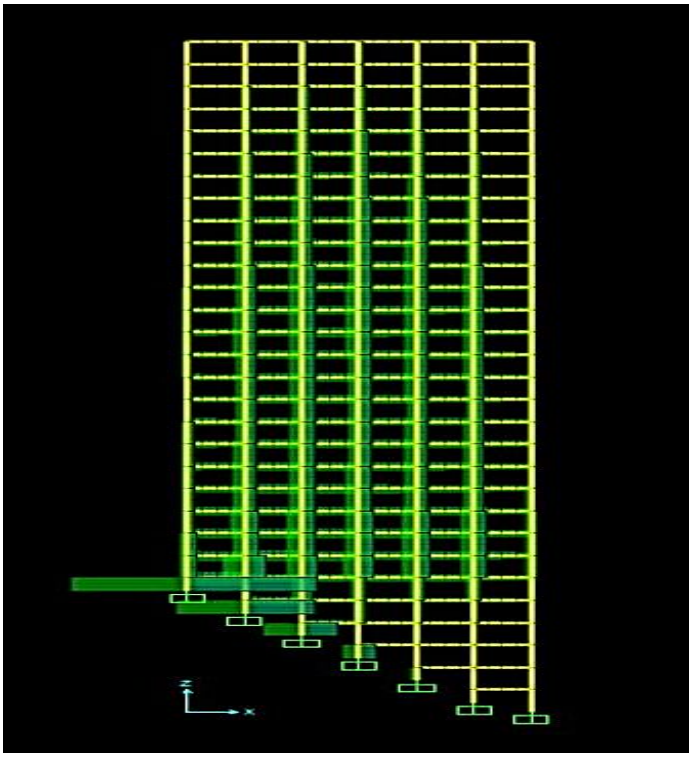

Figure 3: shear force for 30 storey set back building

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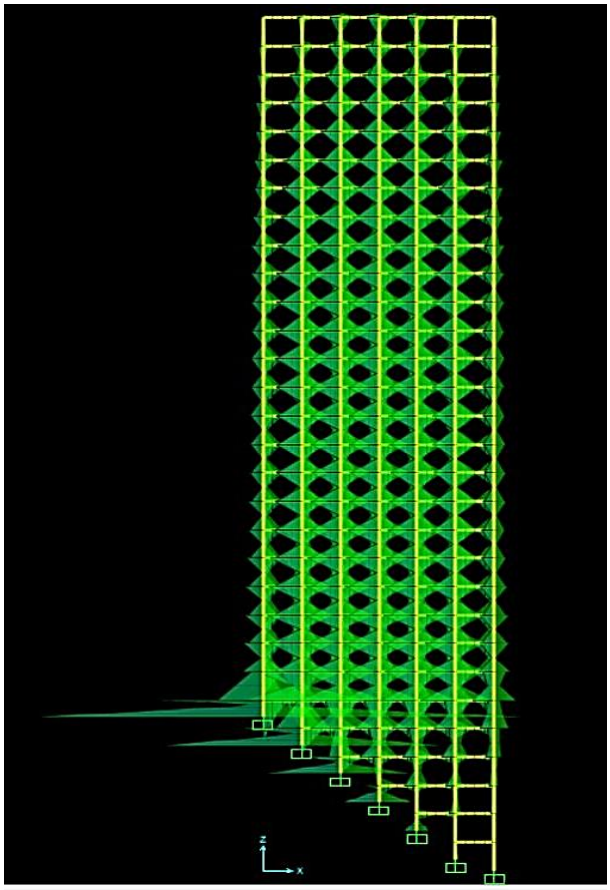

Figure 4: b.m for 30 storey set back buikding

II. AIM AND OBJECTIVES

Aim:
To study the seismic behavior of set back building on sloping ground.

Objectives:

1. Dynamic properties of building on plane ground & sloping ground.
2. dynamic seismic analysis of building on plane & sloping ground at different location.
3. Non-linear time history analysis of building on plane & sloping ground.
4. Study of variation of angles viz 250, 320, and 370 for 30 story set back building.

III. SCOPE OF WORK

- ✓ To determine the short column effect of ground column.
- ✓ To determine shear force, bending moment, axial force, base shear and top storey displacement in X and Y direction.

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IV. SETBACK BUILDING

a) Name of time history: BHUJ
b) Magnitude: 7.7
c) Duration of earthquake: 120 second
d) Peak ground acceleration: 1.0382 m/sec2
e) Time for PGA: 46.940 second
f) Duration: LONG
g) Total no of acceleration records: 26706
h) Time step:0.005 second

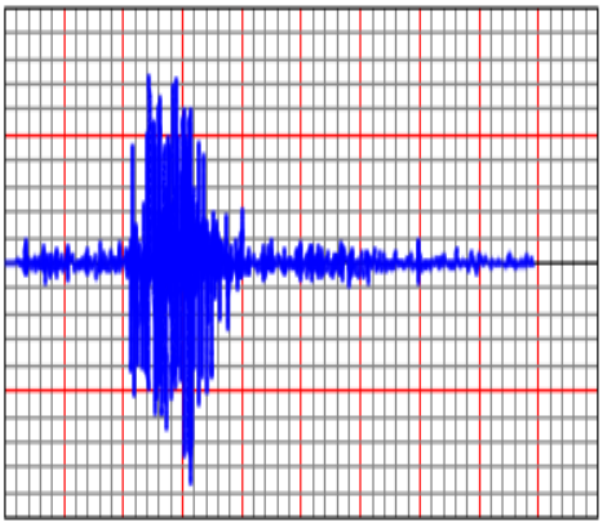


Figure 5: bhuj time period

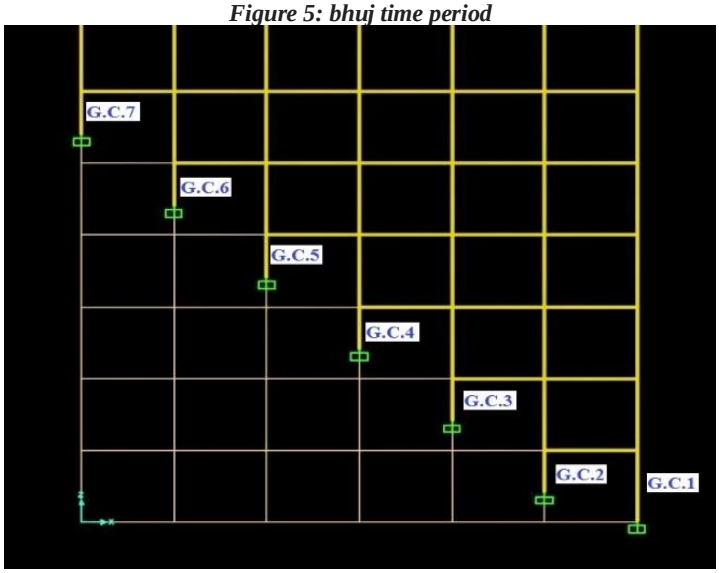


Figure 6: ground column

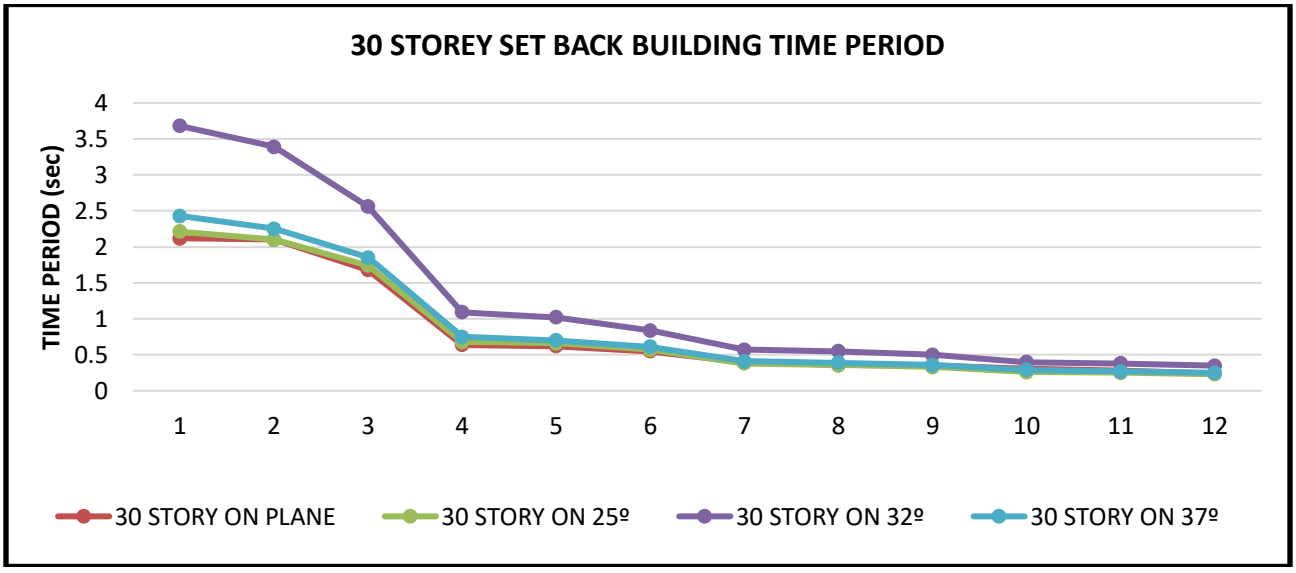
❖ **Dynamic analysis**

They model analysis of the carried out for first 12 modes and dynamic characteristic of plane building and sloped ground building carried. Then performing dynamic analysis of response spectrum analysis has carried 12 modes shape and they consider 92 percentage model participation as per i.s.-1893-2016. The base shear and other

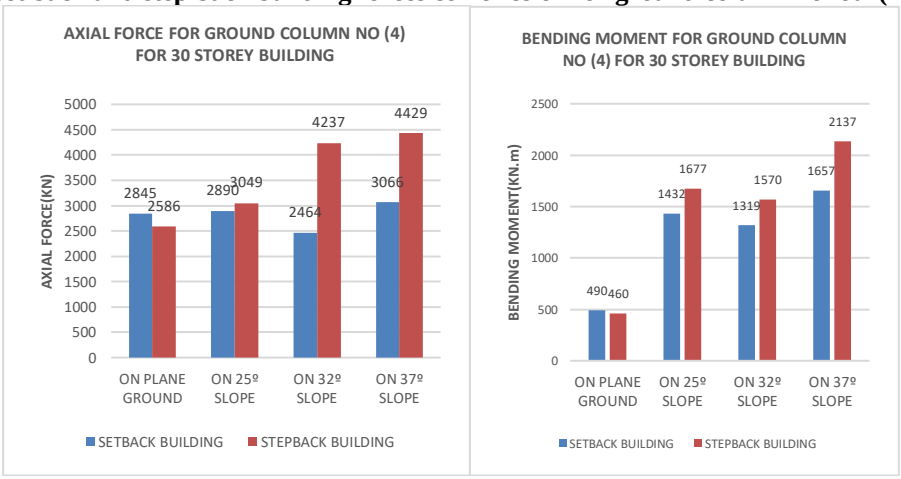
parametric studied in response spectrum analysis, then earthquake time history analysis for Bhuj time history earthquake it also carried by near and far field earthquake.

V. RESULT ANALYSIS

❖ **30 storey set back building time period**



❖ **30 storey set back and step back building forces comerission for ground column no four(4)**



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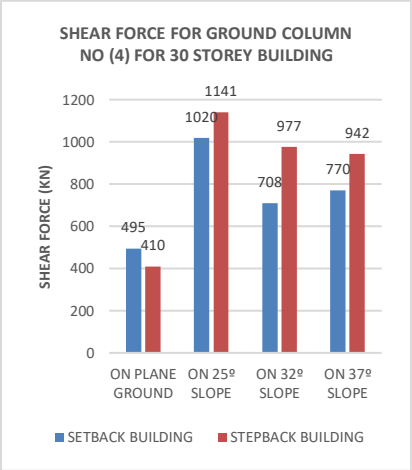
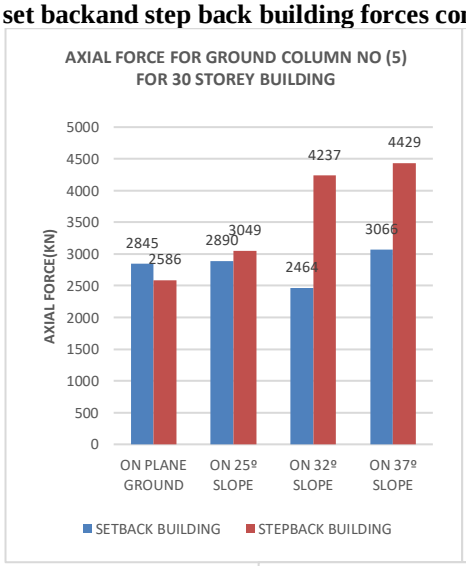
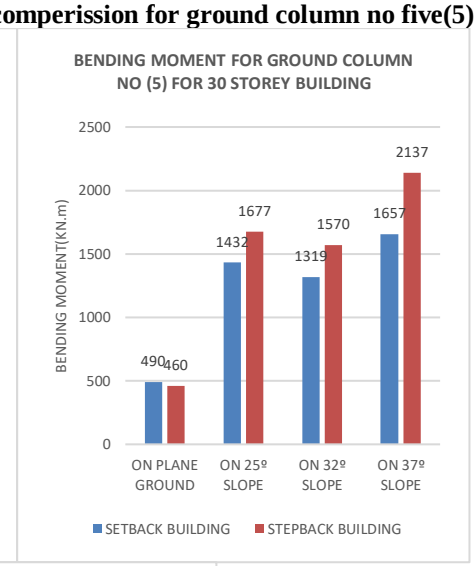
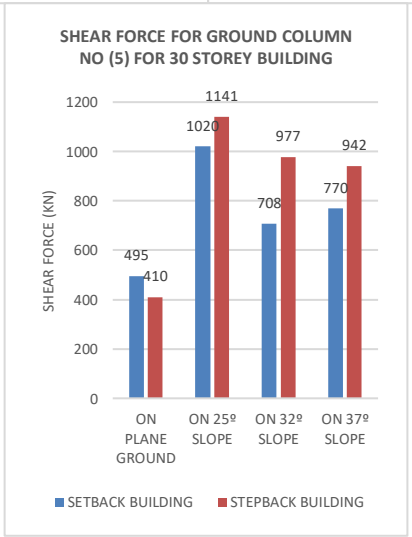


❖ **30 storey set backand step back building forces comperission for ground column no five(5)**







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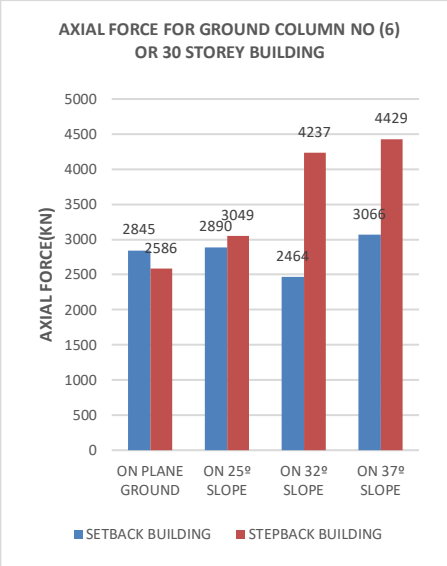
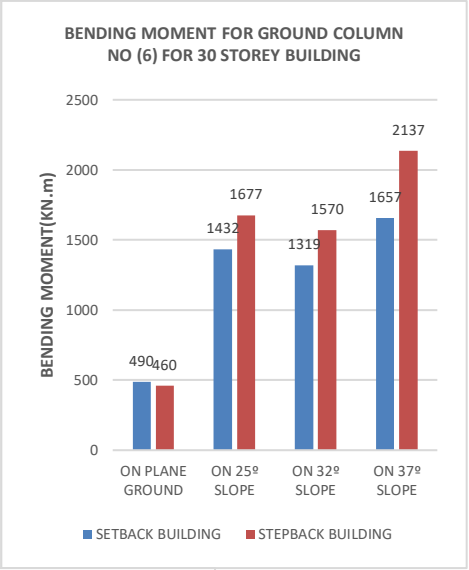
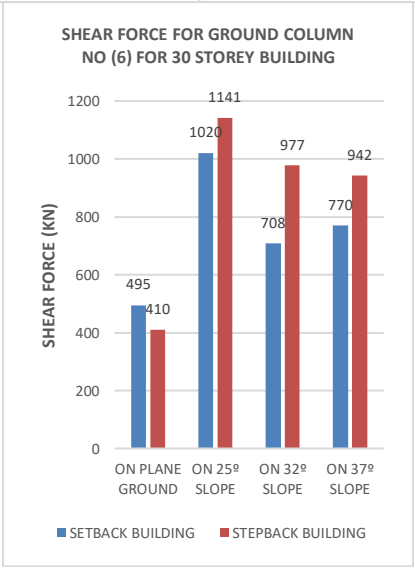
❖ **30 storey set back and step back building forces comperission for ground column no six(6)**







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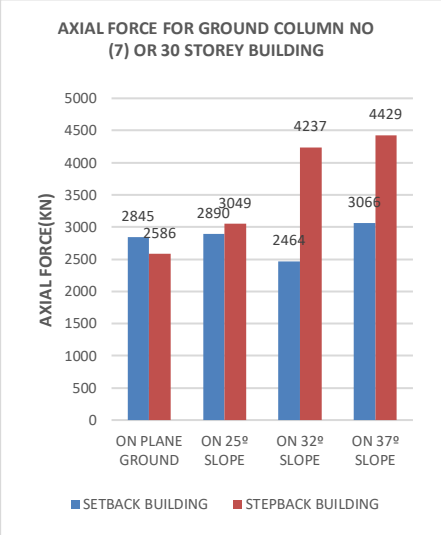
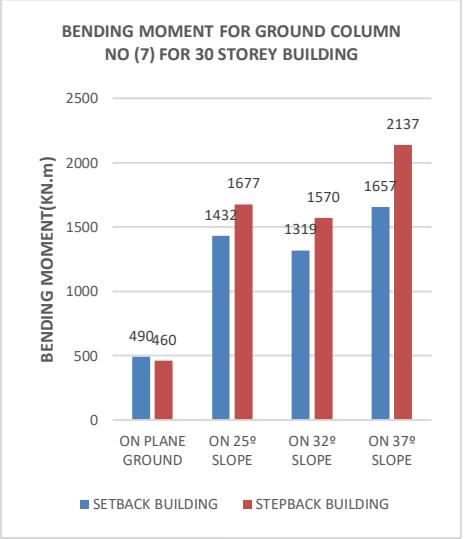
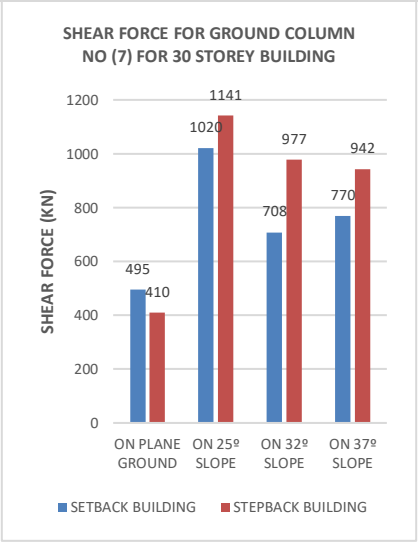
❖ **30 storey set bacc and step back building forces comperission for ground column no seven(7)**







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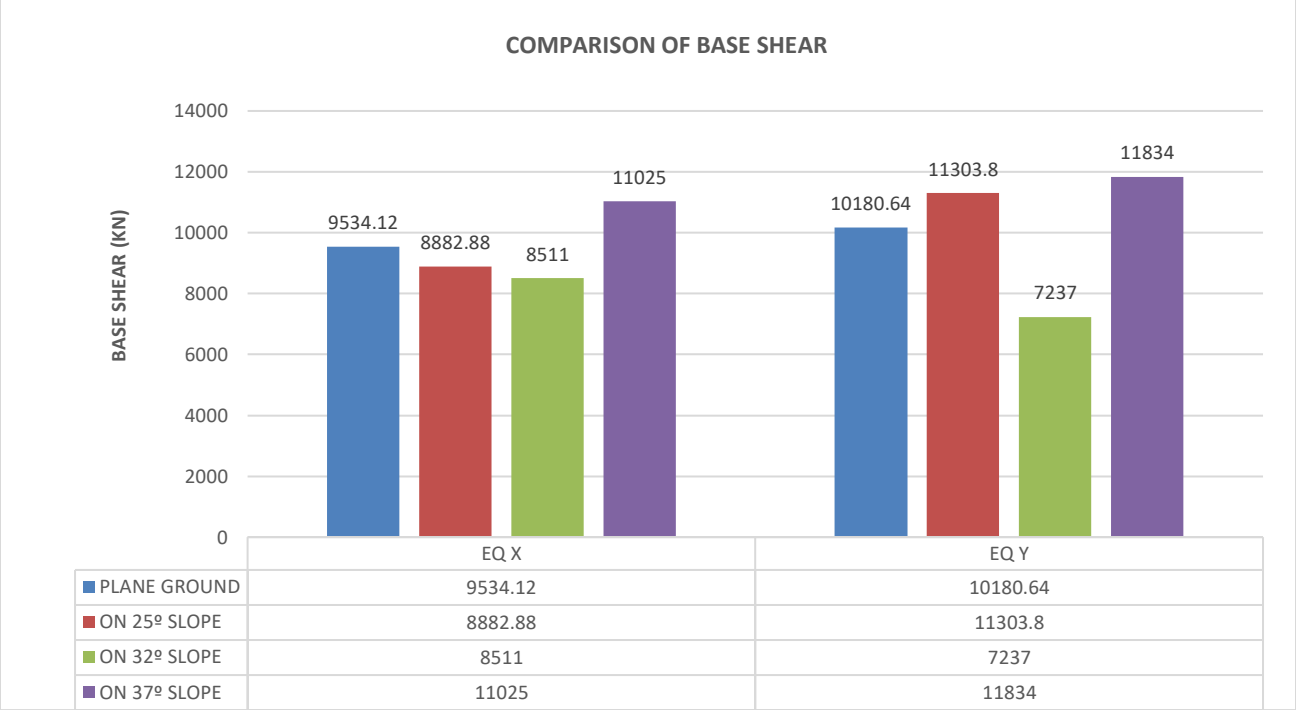
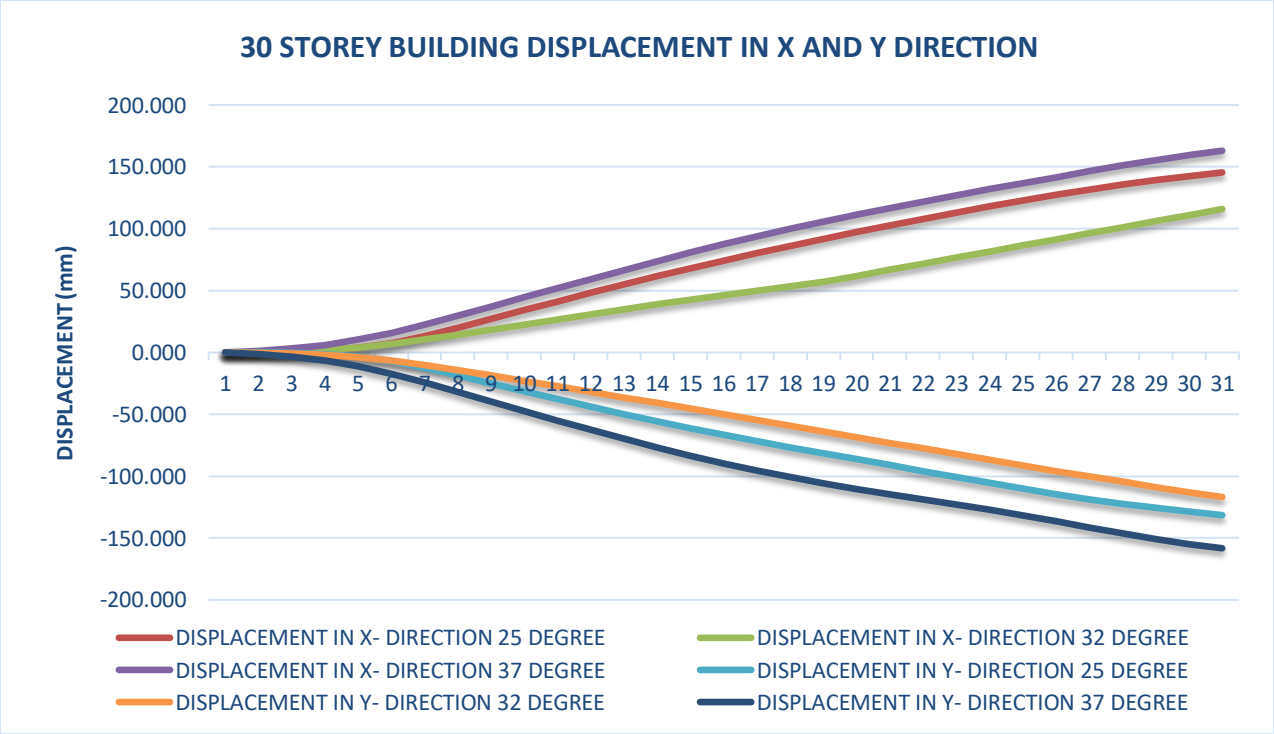
❖ **30 storey set back building base shear**



	EQ X	EQ Y
PLANE GROUND	9534.12	10180.64
ON 25º SLOPE	8882.88	11303.8
ON 32º SLOPE	8511	7237
ON 37º SLOPE	11025	11834

❖ **30 storey set back building displacement in x and y direction**



VI. CONCLUSION

From the present investigation following conclusions are derived.

- Out of all cases considered in investigation we are getting higher time period for 32 degree 30 storey building which is 3.68 second.
- From the obtained results it can be concluded that geometry and masses of buildings will affect only first 4 modes of building and after 4th mode shape time is almost same.
- We can observe that 30 storey building constructed on plain ground is more rigid for higher earthquake.
- Out of all cases value of base shear is higher for30 storey building constructed on the 37-degree sloping ground.
- Value of base shear is comparatively less for 30 storey building constructed on 32-degree sloping ground.
- As ground columns are heavily loaded for dead and earthquake load conditions, we are getting maximum axial force in ground column number one for x and y direction.
- The value of axial force is lowest in 30 storey building constructed on for32-degree sloping ground.
- The ground slope of 25 to 30 degree is worst for shear force in column and higher shear forces are obtained in column for this ranges of slope.
- It is observed that bending moment is very high for ground column number seven 30 storey building constructed on in 37-degree ground slope.
- Bending moment is very low for ground column number seven in plane ground for 30 storey building.
- The displacement at top node for 30 storey building constructed on 37-degree slope is 163.102 mm
- Maximum top storey displacement is 157.27mm for 37 degree 30 storey building for y direction.
- Minimum top storey displacement is 115.956mm 32 degree 30 storey building for x direction.
- Minimum top storey displacement is 116.86 mm 32 degree 30 storey building for y direction.

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3. https://www.www.sciencedirect.com/journal/sesmicbuilding

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IS CODES

1. Indian standard "Criteria for earthquake resistance design of structures" 1893(part 1)-2002
2. Indian standard "Indian standard code for plain and reinforced concrete" Bureau of Indian standard, IS456,2000