WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Seismic Analysis of RCC Buildings on Inclined Ground

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ABSTRACT

The objective of this investigation is to compare the out comes from dynamic method of earthquake analysis performed on R.C. structures with five different configurations like, multistoried building on plain ground, Step back building on 10 to 40 degree slope, Step back Set back building on 10 to 40 degree lope are presented. Analysis containing storey displacement in X and Z directions, base shear, time period and mass participation factors. Also, shear forces, bending moments in both beams and columns are taken into account and axial forces in column computed using Staad pro software and methodology has been carried out by using Response Spectrum Method in this work.

Key Words: Sloping Ground, Multistory Building, Shear Force, Bending Moment

I. INTRODUCTION

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.

Configuration of buildings in sloping ground

Configuration implies the structural and architectural arrangements of the building in sloping terrain. These peculiar structural arrangements comprises of various architectural configurations consist of variation in numbers of bays along the slope. Generally when the building are designed, the building possess vertical irregularity for architectural purpose but the base of such buildings are rested upon flat ground on the other hand these buildings on sloping ground naturally possess slopes in the base which may leads to alter building structural schedules.

II. OBJECTIVE OF THE STUDY

1. To explore the seismic response in the sloping terrain G+14 storied building framed with different configurations comprising building rested on sloping terrain having stepback type configuration, setback setback type configuration and building without and slope.
2. Four different sloping terrains are selected and multistoried building rested at0˚, 10˚,20˚, 30˚ and 40˚to analyze the buildings located on zone III and rested on medium soil.
3. All the models are investigated for various seismic parameters like axial force, shear force, bending moment, base shear, story displacement, time period and mass participation factors and torsion moment in both lateral and longitudinal directions.

III. PROBLEM STATEMENT

3.1 General:

Various models are framed for analysis and assessment of structure to accomplish the aforesaid objectives of the current study.

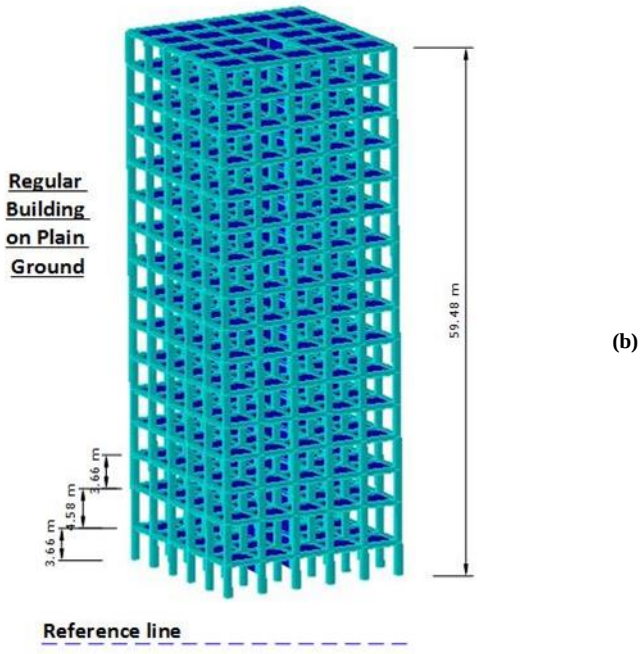
Table 3.1: Different cases with respect to building configurations for Step Back Cases

S. No.	Models framed for analysis	Abbreviation
1.	15 storied regular building rested on flat ground.	A0
2.	15 storied sloping building having step back configuration rested on 10˚ slope.	A1
3.	15 storied sloping building having step back configuration rested on 20˚ slope.	B1
4.	15 storied sloping building having step back configuration rested on 30˚ slope.	C1
5.	15 storied sloping building having step back configuration rested on 40˚ slope.	D1

Table 3.2: Different cases with respect to building configurations for Step Back Set Back Cases

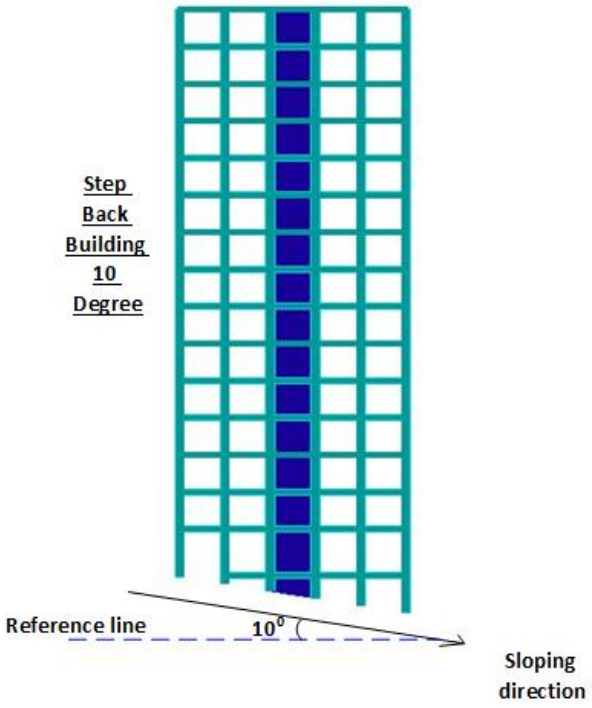
S. No.	Models framed for analysis	Abbreviation
1.	15 storied regular building rested on flat ground.	A0
2.	15 storied sloping building having step back set back configuration rested on 10˚ slope.	A2
3.	15 storied sloping building having step back set back configuration rested on 20˚ slope.	B2
4.	15 storied sloping building having step back set back configuration rested on 30˚ slope.	C2
5.	15 storied sloping building having step back set back configuration rested on 40˚ slope.	D2

3.2 Details of the Models



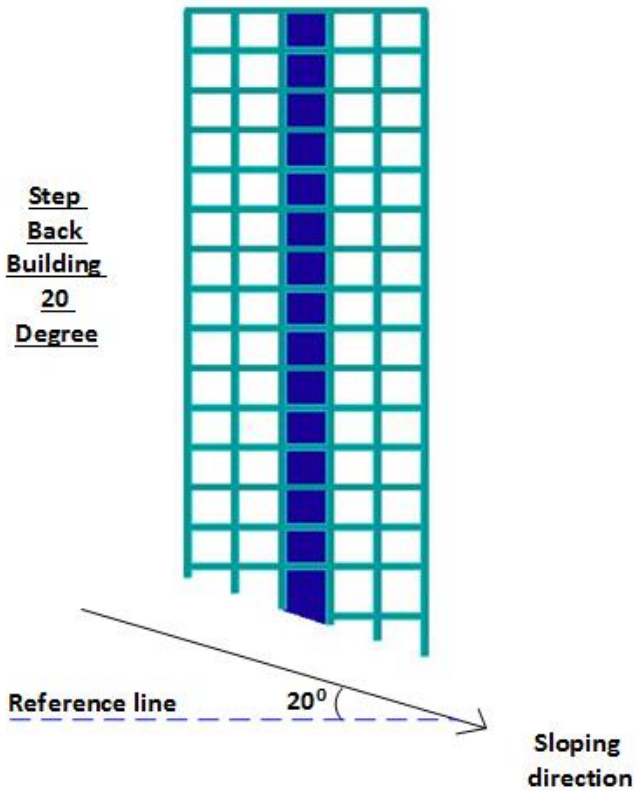
(a) **(b)**

Fig. 3.2: (a) 3- D Rendered view of BuildingA0: Regular building rested on plane ground



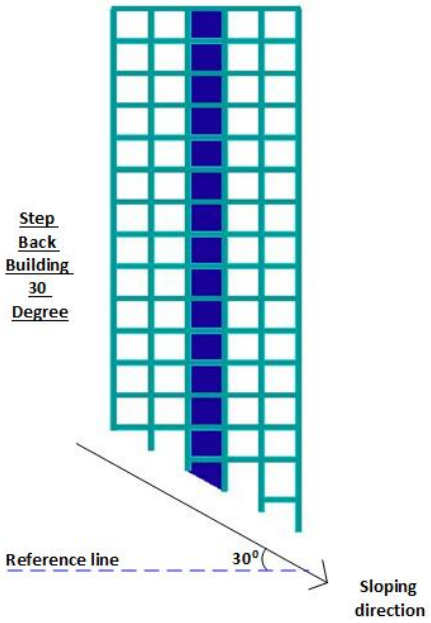
(a)

Fig. 3.3: (a) Rendered view of Building A1: Stepback building rested on 10˚ sloping ground



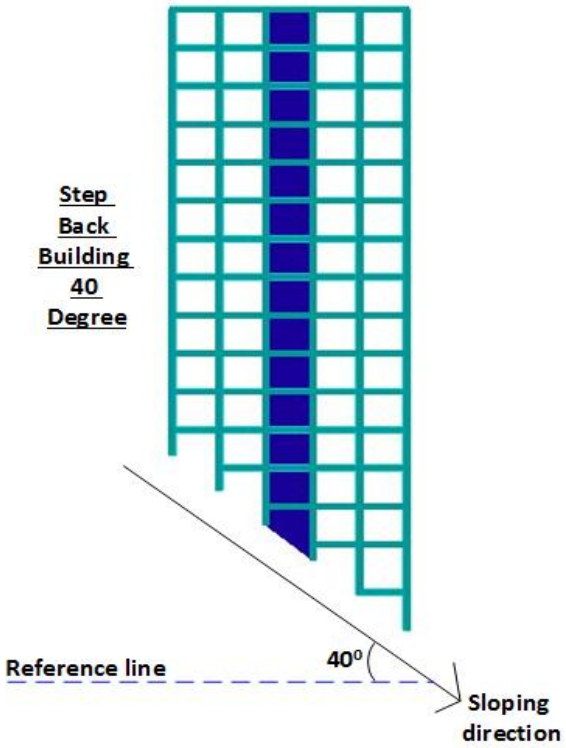
(a)

Fig. 3.4: (a) Rendered view of Building B1: Step back building rested on 20˚ sloping ground



(a)

Fig. 3.5: (a) Rendered view of Building C1: Step back building rested on 30˚ sloping ground



(a)

Fig. 3.6: (a) Rendered view of Building D1: Step back building rested on 40˚ sloping ground

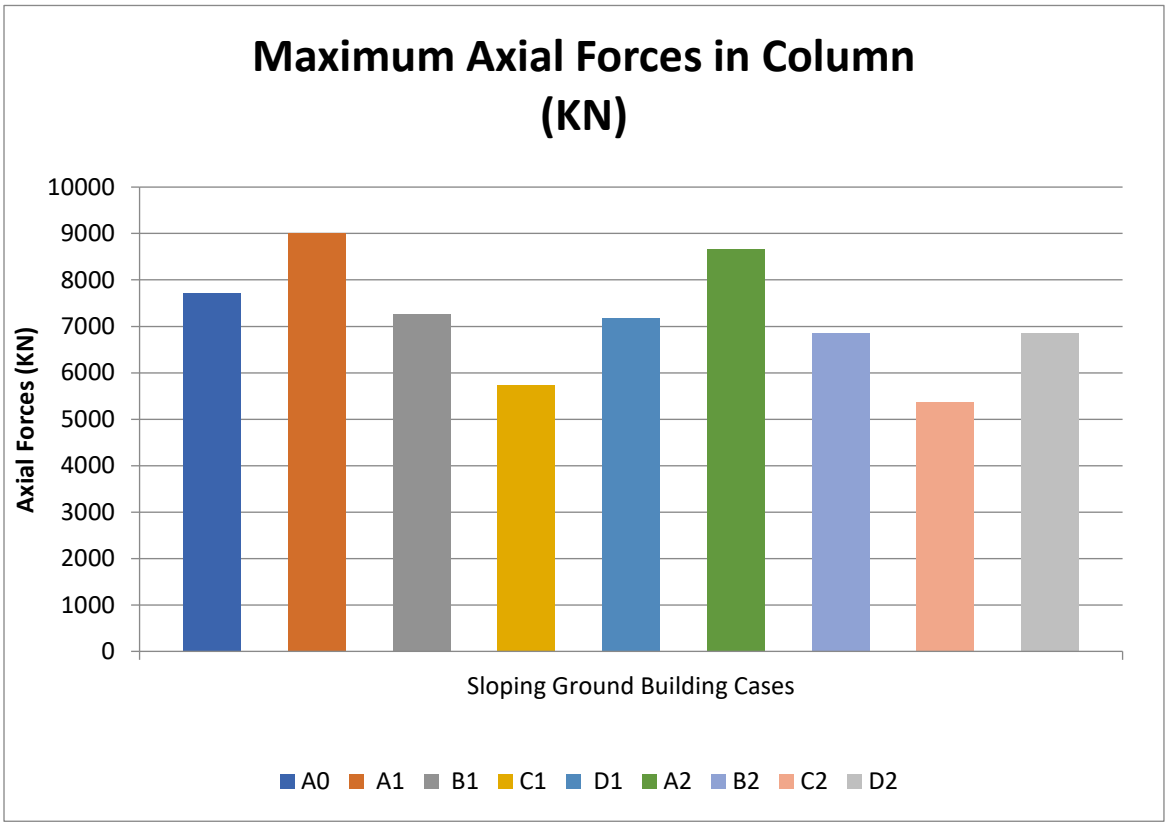
IV. RESULT AND DISCUSSION

4.1 General:

The analysis results obtained using Staad pro software is shown in tabular form along with various graphs with various parameters as follows:

Table 4.1: Maximum Axial forces in column for various building cases

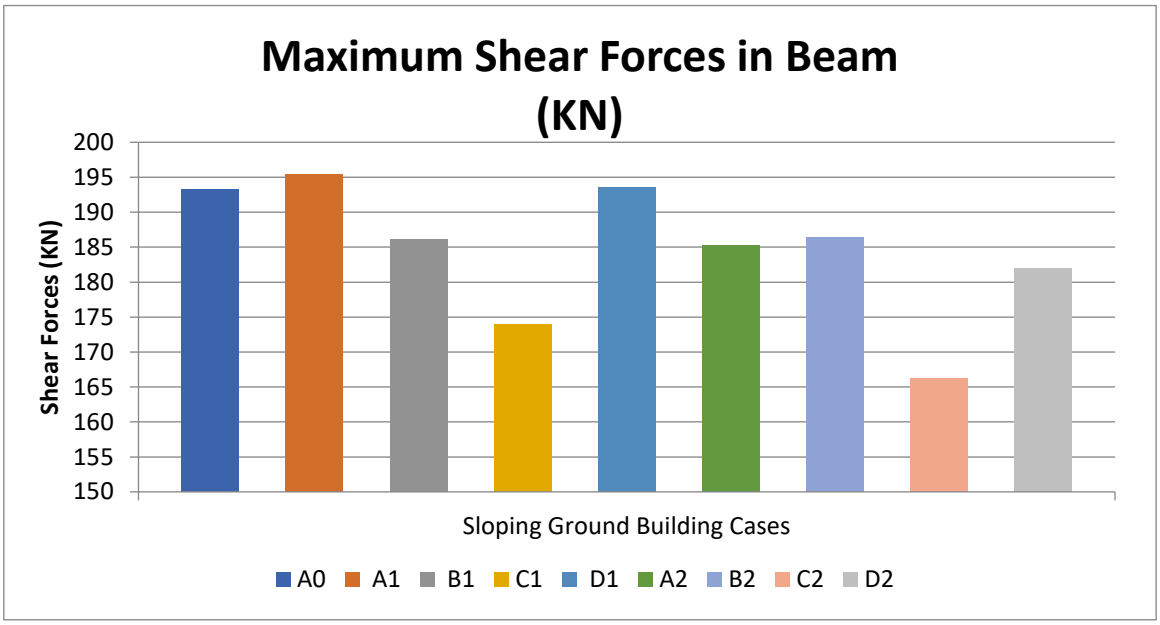
Building	Axial Forces (KN)	Building	Axial Forces (KN)
A0	7709.861	**A0**	7709.861
A1	9017.059	**A2**	8670.360
B1	7275.176	**B2**	6859.171
C1	5732.039	**C2**	5379.167
D1	7167.571	**D2**	6843.198



Graph 1: Graphical representation of Axial Force in column for all building cases

Table 4.2: Maximum Shear Force in Beam for various building cases

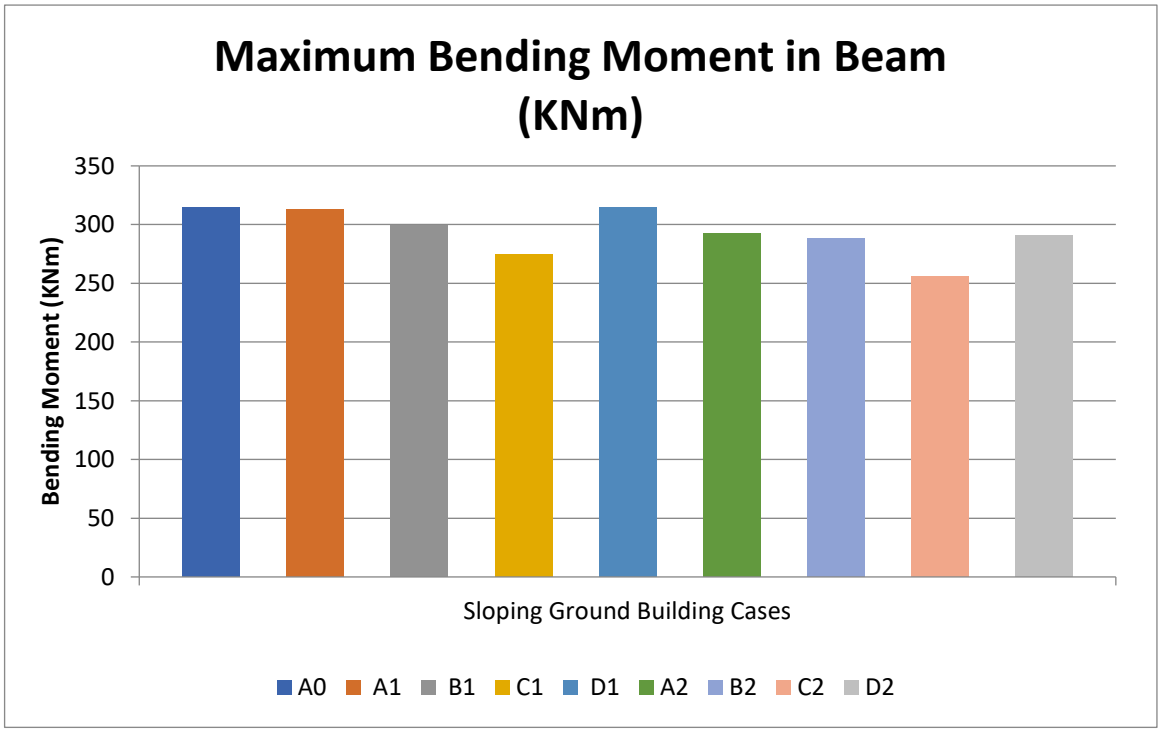
Building	Shear Forces (KN)	Building	Shear Forces (KN)
A0	193.225	**A0**	193.225
A1	195.407	**A2**	185.299
B1	186.121	**B2**	186.381
C1	173.915	**C2**	166.246
D1	193.526	**D2**	181.950



Graph 2: Graphical representation of Shear Forces in Beam for all building cases

Table 4.3: Maximum Moment in Beam for various building cases

Building	Bending Moment (KNm)	Building	Bending Moment (KNm)
A0	314.255	**A0**	314.225
A1	313.177	**A2**	292.659
B1	299.627	**B2**	287.991
C1	274.144	**C2**	256.061
D1	314.976	**D2**	291.165



Graph 3: Graphical representation of Moment in Beam for all building cases

V. CONCLUSION

5.1 Conclusion for Step Back Buildings & Step Back Set Back Buildings

The conclusion can be pointed out are as follows:-

For Step Back Building

1. Maximum Axial forces in column seem to be low in case of building C1, since the load distributed on sloping ground effectively on 30^0 sloping ground.
2. Beam in Both X and Z direction shows least values of shear forces in Building C1 which is rested over 30^0 sloping ground.
3. In case of Moment in beam, other than structure on plain ground, building with step back 30 degree inclination shows least values.

For Step Back Set Back Building

4. Maximum Axial forces in column seem to be low in case of building C2, since the load distributed on sloping ground effectively on 30^0 sloping ground.
5. Beam in Both X and Z direction shows least values of shear forces in Building C2 which is rested over 30^0 sloping ground.
6. In case of Moment in beam, other than structure on plain ground, building with step back Set back 30 degree inclination shows least values.

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