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Dynamic Analysis of a Circular Tall Structure Considering Outriggers Using ETABS

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ABSTRACT

In the Northern and north-eastern parts of INDIA, have huge part of sloping ground which comes in the categories of seismic zone 1V and V. Recently there was huge destruction in Nepal earthquake (2015), Doda earthquake (2013), Sikkim earthquake (2011) because of majority of hilly ground location. Due to rapid urbanization and economic development of INDIA there is a huge demand of multistory RC framed building structure in that region. Due to more population density and scarcity of plain ground we are bounded to construct the building structures in that sloping terrain.

The structures are designed as per the geography of different regions which is based on various aspects.

In this paper presenting review of literatures related to analysis of tall structure.

Keywords: Terrance Analysis, Shear Force, Axial Force, Node Displacement, ETABS, Master Slave.

I. INTRODUCTION

Earthquake is the most dangerous & non predictable disaster of nature. Loss of human lives due to earthquake forces on the building structures does not cause directly but due to the damages causes of the building structures that leads to the collapse of the structures and hence to the livelihood and to the property. There is a special need of investigation required to reduce the mass destruction of the low and high rise of building structures due to earthquake in the developing nation like INDIA.

Building structures subjected to seismic forces are always more prone to collapse and if this phenomenon occurs on a sloping ground building structures as on hills which lies at some inclination angle to the ground, chances of damage suddenly increase much more due to increase in lateral forces like seismic and wind on short column on upward hill side and on the short column side more number of plastic hinges forms. Building structures built on sloping terrain differs from those which are on plains because sloping structures have irregularity in horizontally as well as vertically.

Pratiksha Thombre and Dr.S.G.Makarande (2016) The exploration paper examined examination between slanting ground, with various slant and plain ground building utilizing Response Spectrum Method according to IS 1893-2000 The dynamic reaction, Maximum uprooting in segments was investigated with various designs of inclining ground. An RCC medium-ascent structure of 5 stories with floor tallness 3 m exposed to seismic tremor replenishing in V was considered. In such a manner, STAAD Pro V8i programming was viewed as an apparatus to perform. Impact of the slanting impact of the ground on the conduct of basic edges was analyzed. Relocations were determined for five unique segments.

The conclusion expressed that Analysis of an alternate design of structures was continued inclining and level ground. The conduct of the structure on the slanting ground was explored. On the slanting ground, the relocation of the structure introduced similar conduct starting at a normal structure. The relocations esteem gets less as the slants increments because of the abbreviation of the segment.

Objectives of the study

Numerous irregular designed structures with various establishment levels are built with locally accessible conventional material in sloped ground because of absence of plain land in uneven areas. As a result of populace density demand of such kind of working in uneven inclines is increased. The investigation of earthquake safe expanding on slants with various sort of soils is required to keep the loss of life, property amid earthquake ground movement.

Main objectives of this study are:

- To observe the effect of earthquake using dynamic analysis method (response spectrum) on terrain slope.
- To observe the effect of different types of soils on the tall structure.
- To observe the variation due to sloping ground.
- To observe the effect of rigid diaphragm using master slave command on a building frame considering seismic forces.
- To study the variation of shear force, bending moment, axial force and Node displacement at different slopes.

II. METHODOLOGY

Step-1 selection of building geometry with three different type of soil, symmetrical 3 bays of 4-4-4-meters G+8storey of 3D frame. Fig.

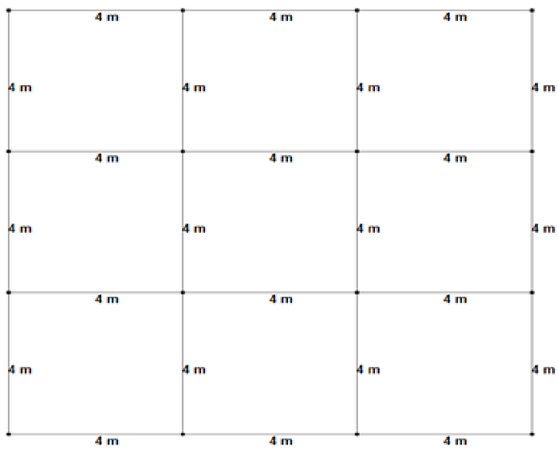


Fig 1 View of the Plan

Step 2: Providing slopes of 0°, 10°,and 15°

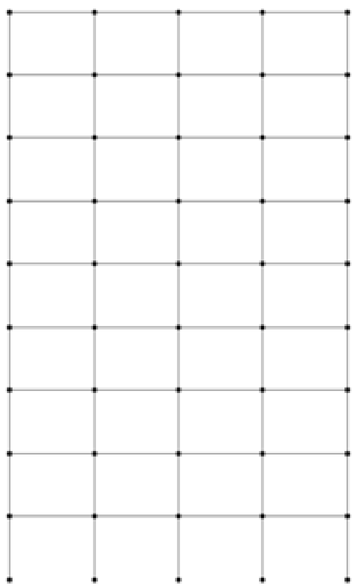


fig: 2 elevation 0 ° slope

fig: 3 elevation 10° slope

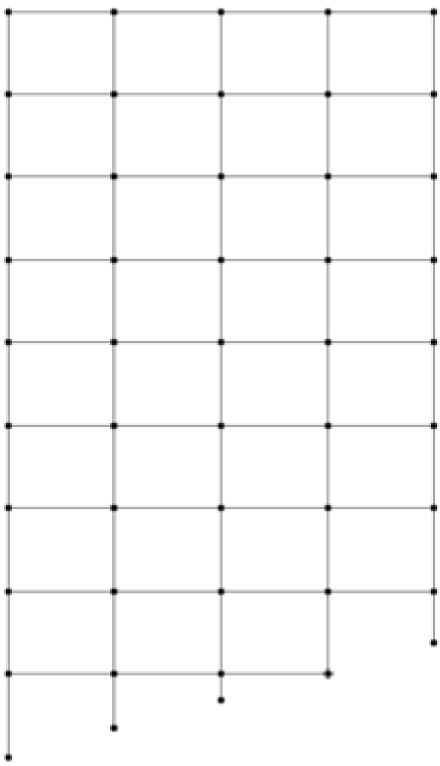
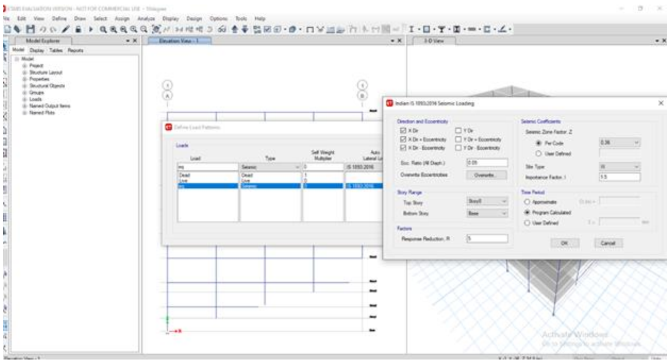


Fig: 4 elevation 15° slope

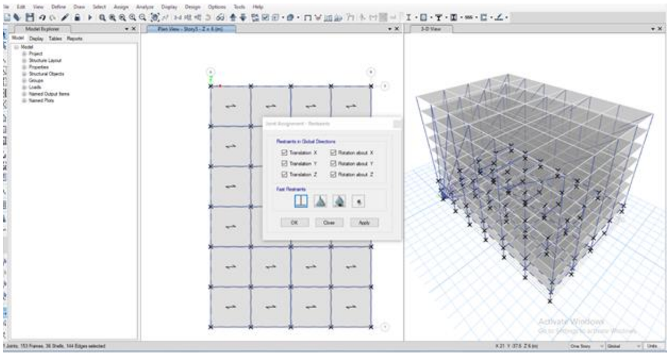
Step-3 providing different seismic zones with soil condition to create various cases to studyas per I.S. 1893: 2002 part 1.

Table 1 seismic zones

Seismic Zone	II	III	IV	V
Intensity	Low	Moderate	Severe	Very Severe
Z.	0.10	0.16	0.24	0.36



Step-4 provide fixed support at bottom and loads dead and live as per 875 part1 and part2



step-5 loading combinations for dead, live and seismic considered.

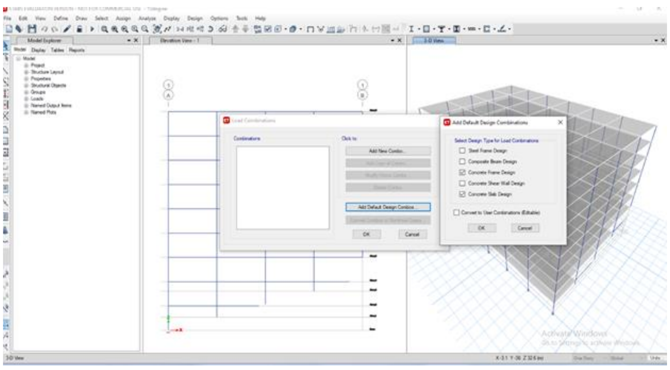
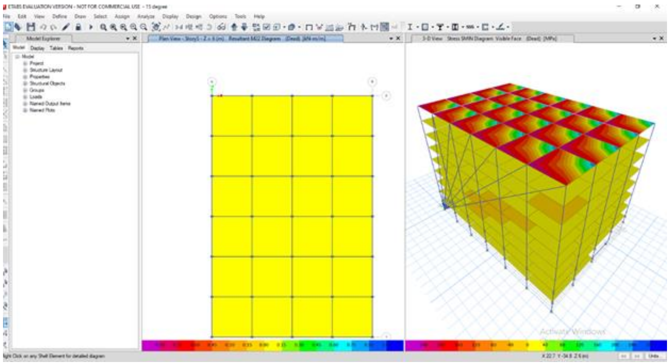


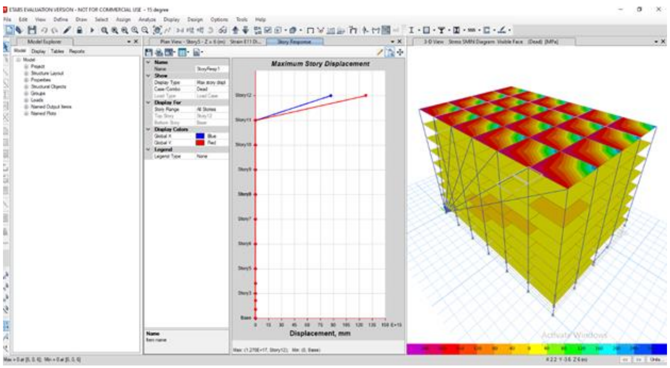
Table 2: total Number of load cases

Load case no.	Load cases
1	D-L
2	L-L
3	EQ_X
4	E.Q._Z
5	1.5(D-L+L-L)
6	1.5(D-L+E.Q.+X)
7	1.5(D-L-E.Q.+X)
8	1.5(D-L+E.Q.+Z)
9	1.5 (D.L-E.Q.+Z)
10	1.2(D.L+L.L+E.Q.+X)
11	1.2 (D.L+L.L-E.Q.+X)
12	1.2 (D.L+L.L+E.Q.+Z)
13	1.2 (D.L+L.L-E.Q.+Z)

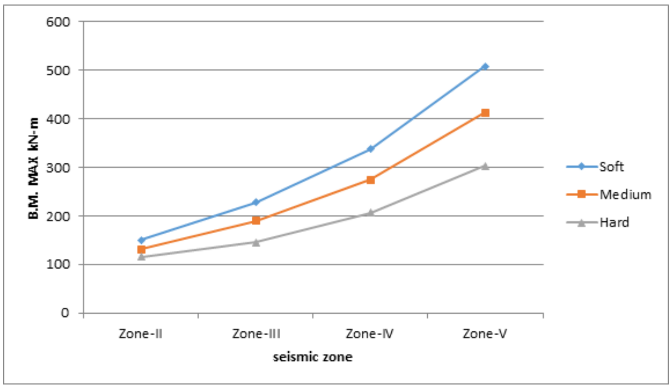
Step-6 Analysis of structures to determine forces and deflection:

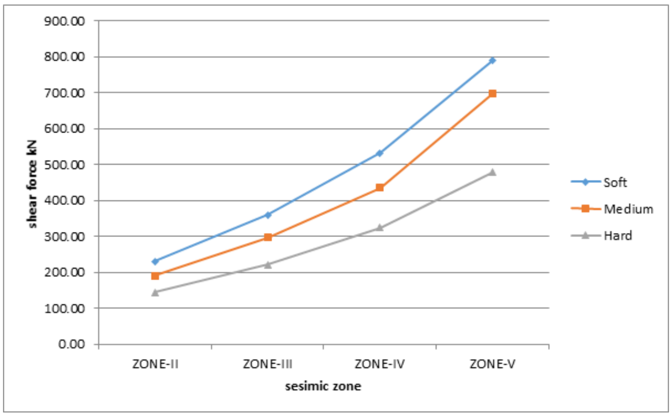


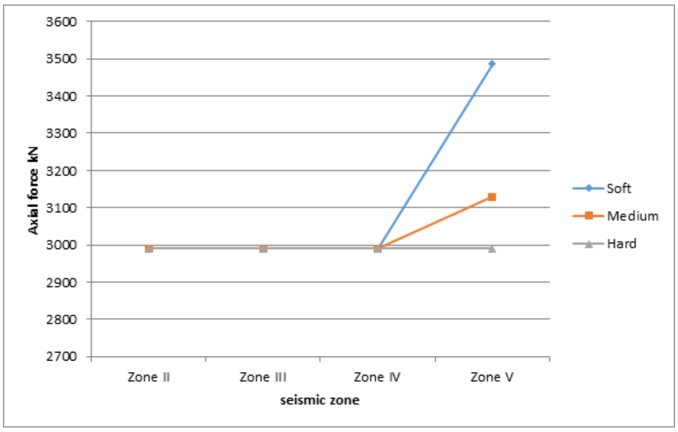
Step-7 Analysis of results as Bending moment, Shear Force, node displacements, story displacement, and Maximum Axial forces.

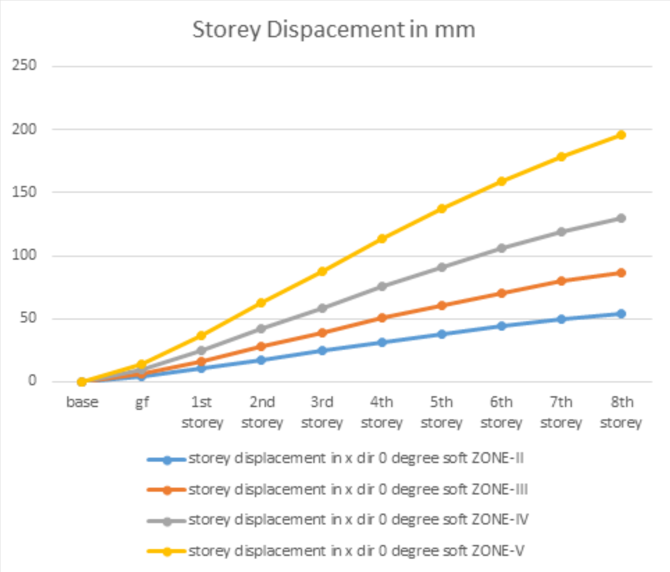


III. ANALYSIS RESULT









IV. CONCLUSION

- It was response spectrum analysis, Base shear in the building increases upto 12 % building made on 15° sloping ground compare to building made on plain ground.
- When the bending moment of the building on plain ground and ground with slopes were compared the bending moment had an increment upto 7 % on 10° slope and 62 % on 62 % slope.
- 15 degree sloped frame experiences maximum storey displacement due to low value of stiffness of short column while the 0 degree frame experiences minimum storey displacement.

In the above chapter it is clearly shown that frame with consideration of slab stiffness provides a variation of 0.98 to 1.01 times in axial forces of column compared to frame without consideration of slab stiffness. There is no significant change in axial force of columns for the given loading. Torsional and bending moment in columns are negligible and the change is insignificant due to introduction of slab.

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