International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 06 | June - 2022 Impact Factor: 7.185 ISSN: 2582-3930

ANALYSIS OF A HIGH RISE BUILDING STRUCTURE CONSIDERING SEISMIC FORCES AT SLOPING GROUND USING ANALYSIS SOFTWARE

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Abstract:

In the northen 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. Structures are characterized as structures used by the general population as safe house for living, working or capacity. As now a days there is lack of land for building more structures at a quicker development in both private and modern ranges the vertical development is given due significance due to which mid rise Buildings are being expand on an extensive scale. In the project, comparing a G + 8 mid-size structure consisting of semi rigid diaphragm by master slave method on different sloping ground under the effect of seismic force as per Indian standards 1893-part-1 all four zones (ii, iii, iv & v) with different soil conditions (soft, medium & hard soil condition) using ETABS software and studied the variations in frame forces, nodal displacements and support reactions also comparing storey displacement of mid rise structure considered.

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

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.

The impact of step-like incline geology on seismic ground movement has not been completely inspected previously, notwithstanding that there is undeniable confirmation of its noteworthiness even from the late 1960s. Actually, this type of surface geology has drawn minimal consideration among researchers, when contrasted with slopes and ravines, in spite of its centrality in building hone. One conceivable reason is the non-symmetric geometry of step-like inclines, which entangles expository arrangements and supports for the most part site particular numerical reenactments whose conclusions are hard to sum up, expanding on slanting territory.

OBJECTIVES

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.

LITERATURE SURVEY

PratikshaThombre 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.

Sachin Kumar Dangi and Saleem Akhtar (2019)In the examination, the seismic conduct of RC structures on the inclining ground was analyzed considering the G+6 storey outline calculations with shear divider and without the shear divider at various slants. The displaying and investigation were finished utilizing STAAD Pro v8i. The goals of the investigation were to examine 3-D working with a shear divider under seismic loads on various slants for example 15°, 30° and 45°, examine the variety of shear power, bending moment, pivotal power and Node relocation at various inclines and contrast the conduct of RC building and shear divider and without a shear divider on slanting ground to recognize the better area of the shear divider. The conclusion derived from the exploration expressed critical improvement saw in seismic execution of expanding on the inclining ground by giving shear dividers various setups since parallel dislodging and part forces diminish extensively in working because of the arrangement of shear dividers. It is seen that most extreme removal is found on account of 45° incline without a sheardivider. Henceforth, the danger increments with the tendency of the incline. The situation of the shear divider at the fringe is the ideal situation for the parallel load opposition. The situation of the shear divider at a corner was the ideal situation for countering hub loads. Greatest shear power and most extreme bending moment increment altogether for the

inclining ground at 45° slant. Axial force increments in the structures with the shear divider. Base shear is discovered greatest in the structure with the shear divider, because of the dead load of the shear divider.

Methodology:

This study presented comparative study of mid rise structures G+8 building frame considering different seismic zones with three different soil types and different slope of ground as 0o, 10o and 15o. Under the seismic effect as per IS 1893(part I) -2002 dynamic analysis.

A comparison of analysis results in terms of displacements, bending moment, Story Displacement, shear force has been carried out. This study is attempted in following steps:

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.

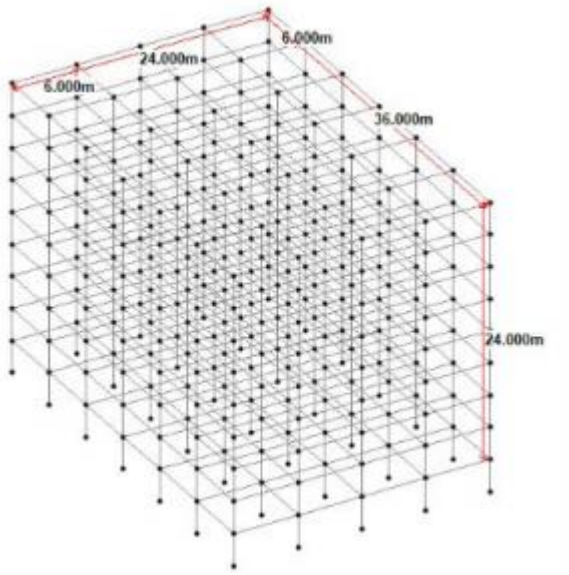


Fig 1: modelling of the structure

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

Step-3 providing different seismic zones with soil condition to create various cases to studyas per I.S. 1893: 2016 part 1.

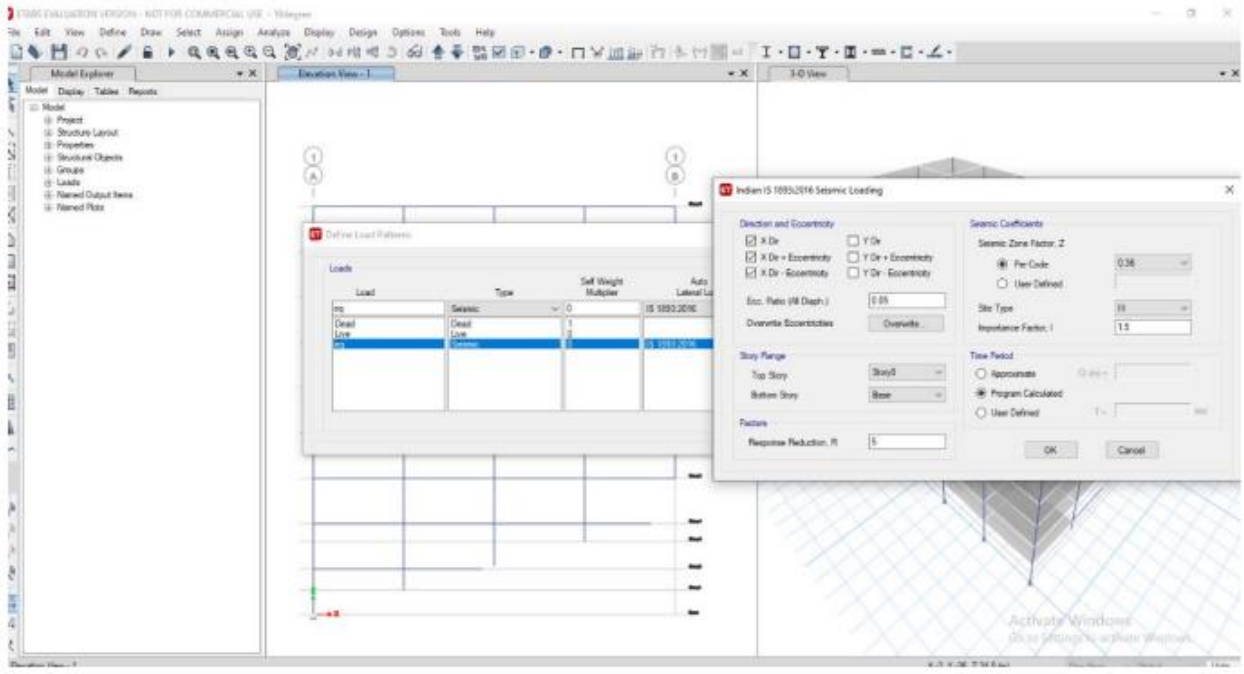


Fig 2: Lateral Forces

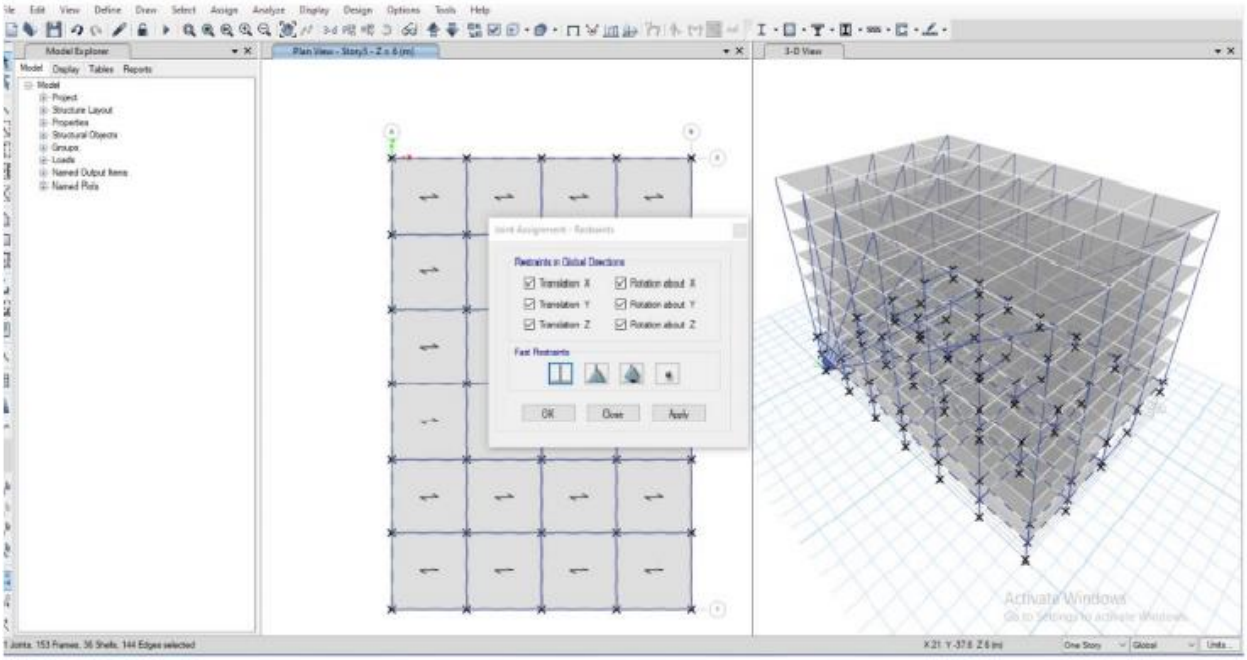


Fig 3: Loading conditions

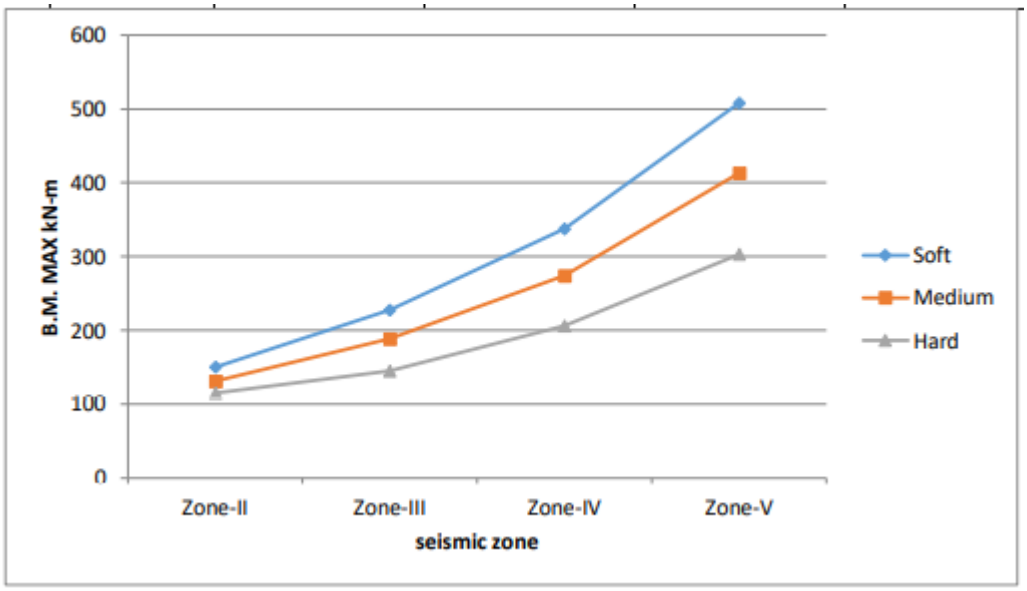
GEOMETRICAL PROPERTIES

Following geometrical properties has been considered with materials in modeling:- • Density of R-C-C: 25kN/m3 • Density of Masonry: 18.25 k.N./m3 The geometry of structure towards length is 4.0 x 4.0 x4.0 x 4.0 (14.0 m)

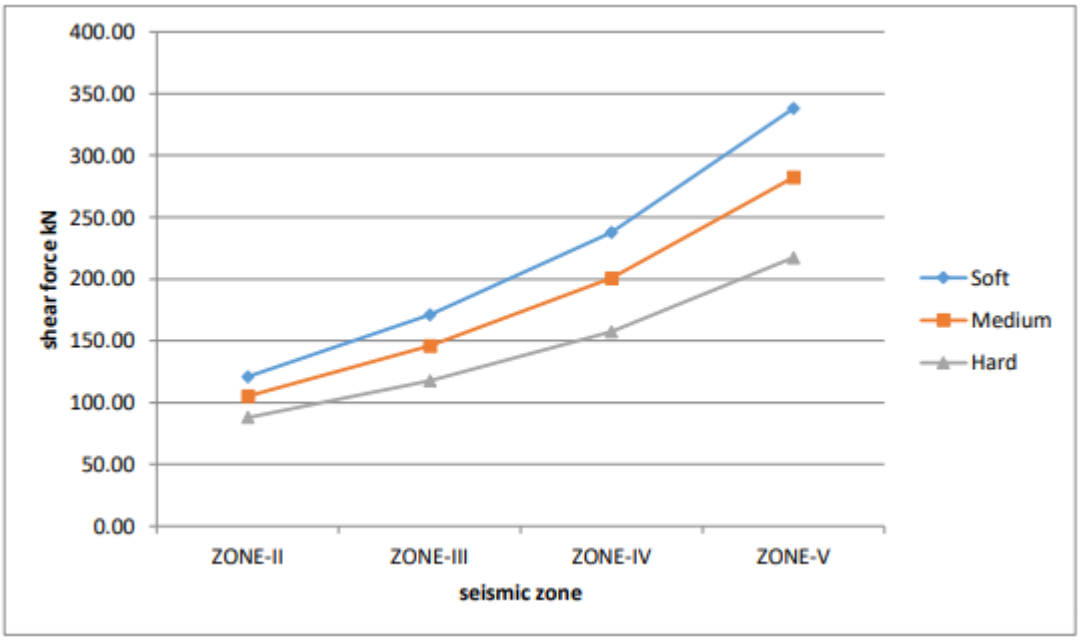
respectively and in Z direction is 4.0 x 4.0 x 4.0 x 4.0(16.0 m) respectively, the storey height of each floor is 3.0m. The sections of columns are considered of 400 mm x 400 mm and the section of beam size is 350 mm x 280mm

Analysis Result:

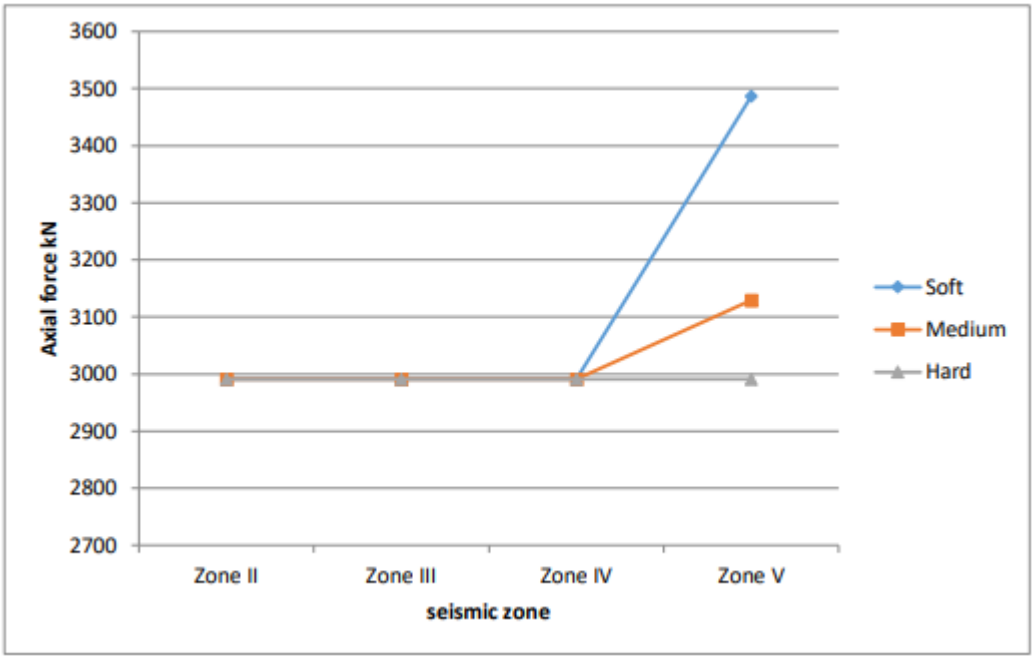
Bending Moment:



Shear Force



Axial Force



CONCLUSIONS

Following are the conclusions as per study

- It was response spectrum analysis, Base shear in the building increases upto 12 % building made on 15o 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 10o 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.

Clearly observed 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 moments in columns are negligible and the change is insignificant due to introduction of slab.

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