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Seismic Soil Structure Interaction Effects on Regular and Irregular Buildings

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***Abstract:*-- As the structures are supported on soil but many structural designers do not consider the soil structure interaction (SSI) effects at the time of earthquake. The main objective of this present study is to find out effect of soil structure interaction on regular and irregular buildings with stiffness irregularity in high damage risk zone. In the present study , an attempt is made to find out soil structure interaction on buildings using E-TABS2015 and parameters like storey drift and storey displacement are being compared by applying time history analysis with different soil conditions i.e. hard(type-I), medium(type-II) and soft(type-III) in seismic zone IV.**

key words: soil structure interaction, stiffness irregularity, time history analysis.

I. INTRODUCTION

Soil structure interaction is one of the most important areas of research in structural engineering now days. Soil structure interaction is a process in which motion of structure is influenced by the response of the soil and the response of the soil is influenced by motion of structure. Due to earthquake, failure of structure occurs and it starts at weak part of the structure. Also the weakness in structure occurs due to discontinuity in mass, stiffness and geometry and such type of structures comes under the category of irregular structures. During an earthquake, the major reason due to which a structure fails is the vertical irregularity. The analysis and designing part of structure becomes more difficult and complicated when these structures are constructed in high seismic prone zones i.e. zone IV o zone V.

METHODOLOGY

In the present study the analysis has been done for a 9 story building using ETABS 2015. Finite element analysis was done using the time history analysis. The properties for the model generated are as mentioned.

Table 1: STRUCTURAL PROPERTIES

Plan dimension	16X15 m^2
No. of stories	9
Floor o floor height	3000mm
Beam size	250X500 mm^2
Column size	450X450mm^2
Thickness of slab	150mm
Zone	IV
Zone factor	0.24
Importance factor	1
Response reduction factor	5
Grade of concrete	M 30
Grade of steel	Fe415
Density of concrete	25 kN/m^3

2: LOADING PROPERTIES

Gravity load	**Value**
Slab load (dead load)	3.75 kN /m^2
Floor finish	1.0 kN /m^2
Roof finish	1.0 kN /m^2
Live load	3.0 kN /m^2

In the present study a comparison between a regular building (model I), an irregular building without slab on story 1(model II) an irregular building having double the thickness of the slab on the story 1(model III) was done. Different soil conditions as recommended by the IS code 1893:2002 part I was considered i.e. soil type I , soil type II and soil type III, which indicates hard , medium and soft soil respectively. Various parameters such as story displacement and drift index for different types of soil have been calculated and compared keeping support condition as fixed.

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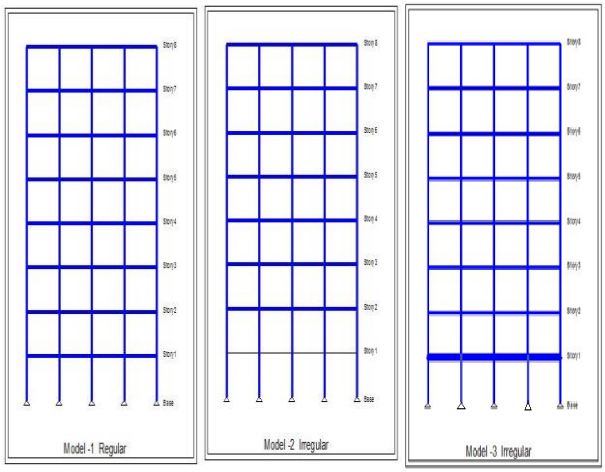
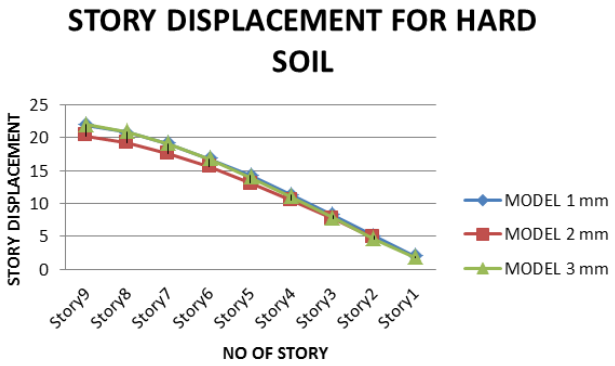
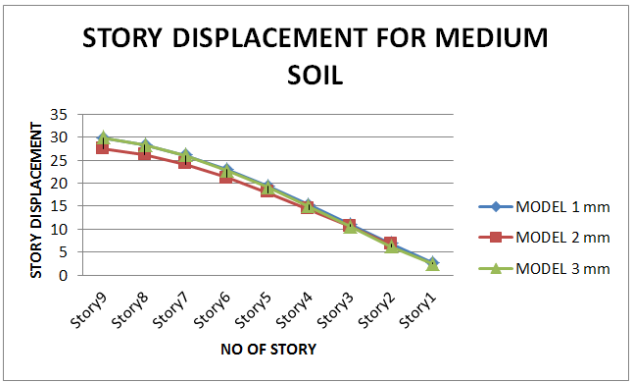


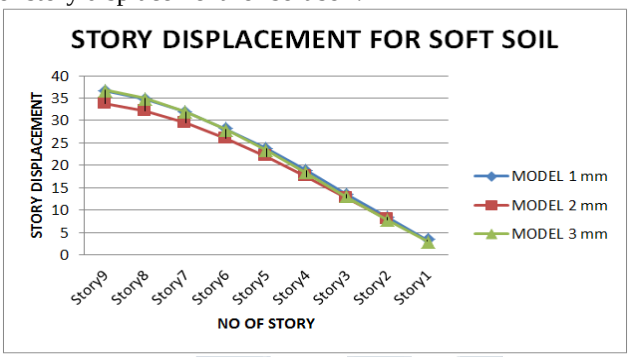
• The graph shows the story displacement for hard soil for MODEL I , II and III. The behavior of model I and III are found almost the same whereas model II shows lower values of story displacement for hard soil.



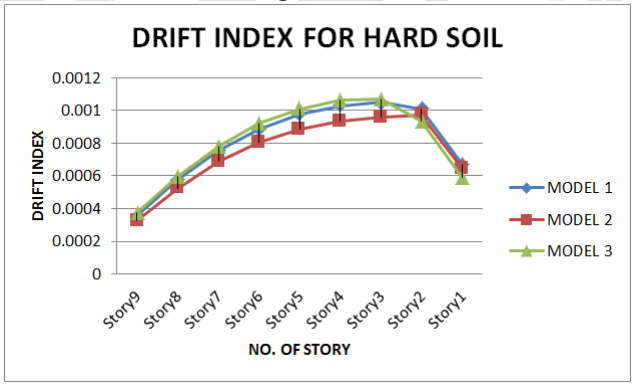
• The graph shows the story displacement for medium soil for MODEL I , II and III. The behavior of model I and III are found almost the same whereas model II shows lower values of story displacement for medium soil.



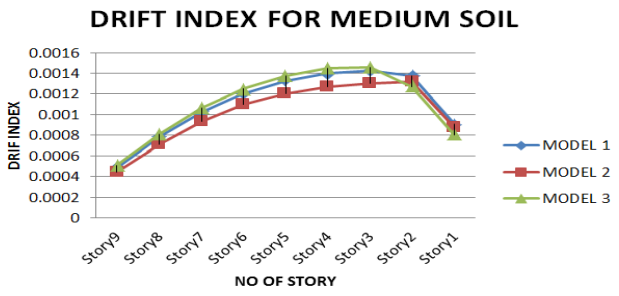
• The graph shows the story displacement for soft soil for MODEL I, II and III. The behavior of model I and III are found almost the same whereas model II shows lower values of story displacement for soft soil.



• The graph shows the drift index for hard soil for MODEL I, II and III. The behavior of model I and III are found almost the same whereas model II shows a lower value of drift index for hard soil but model III shows the minimum value of drift index at the ground floor.



• The graph shows the drift index for medium soil for MODEL I, II and III. The behavior of model I and III are found almost the same whereas model II shows a lower value of drift index for medium soil but model III shows the minimum value of drift index at the ground floor.



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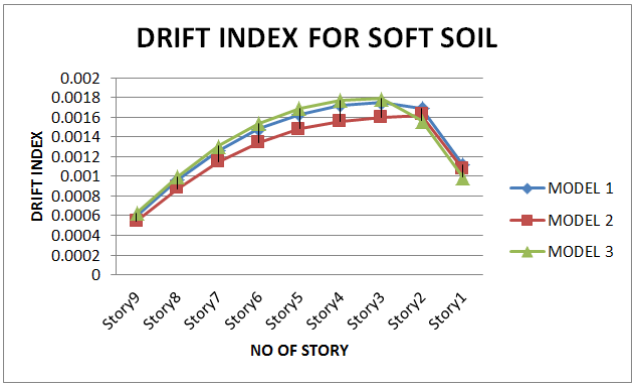

CONCLUSIONS

• The results shows that the behavior of model I and III i.e. the regular building and the building with double the depth of slab are almost the same but model II i.e. the building with no slab on story 1 shows the best result for story displacement for all types of soils.

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