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Seismic Effect of Soil Structure Interaction on Regular and Irregular Buildings

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***Abstract*— The main objective of this study is to find out soil structure interaction effectson regular and irregular buildings with vertical irregularity i.e. stiffness irregularity in zone prone to higher seismic disturbances. In this present study , a finite element method is used and parameters like base shear and stiffness have being compared among three models by applying time history analysishaving different soil conditions i.e. hard(type-I), medium(type-II) and soft(type-III) in seismic zone IV using E-TABS2015.**

Keywords— soil structure interaction, stiffness irregularity, time history analysis.

I. INTRODUCTION

An earthquake causes failure in a structure at weak point. Causes of weakness in the structure occur due to discontinuity in mass, stiffness or geometry in the structure. At the time of earthquake vertical irregularity in structure becomes the major reason of failure. When structures with vertical irregularity are analyzed and designed then the complications increases. So considering the seismic effects of soil structure interaction is an important factor. In the present study three models which are model 1(regular), model 2(without slab on story I) and model 3(slab with double thickness on story I) were considered for analysis.

II. 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

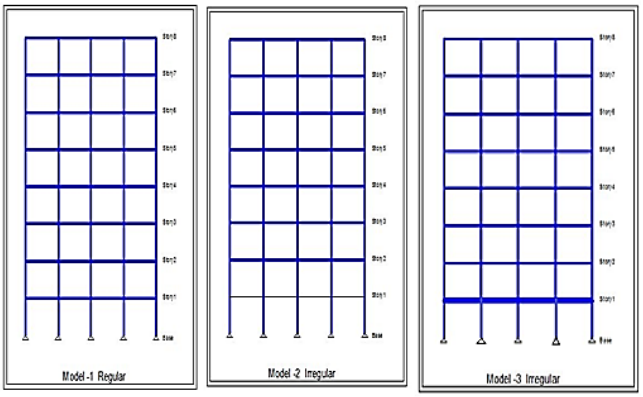
Plan dimension	16X15 m^2
No. of stories	9
Floor to floor height	3000mm
Beam size	250X500 mm^2
Column size	450X450mm^2
Thickness of slab	150mm
Zone	IV
Zone factor	0.24
Importance factor	1
Response reduction factor	5
Grade of concrete	M30
Grade of steel	Fe415
Density of concrete	25 kN/m^3

Density of concrete 25 kN/m3

II. 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 base shear and stiffness for different types of soil have been calculated and compared keeping support condition as fixed.



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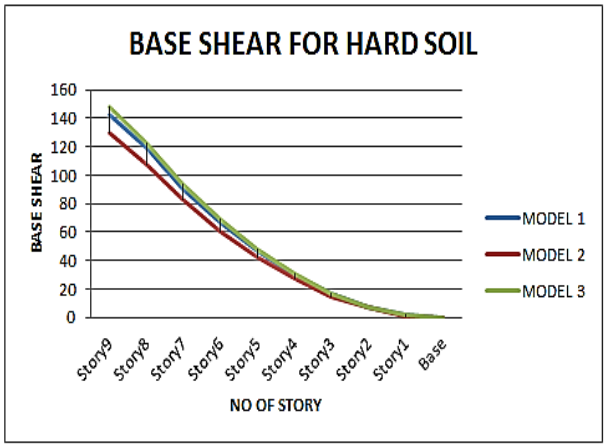
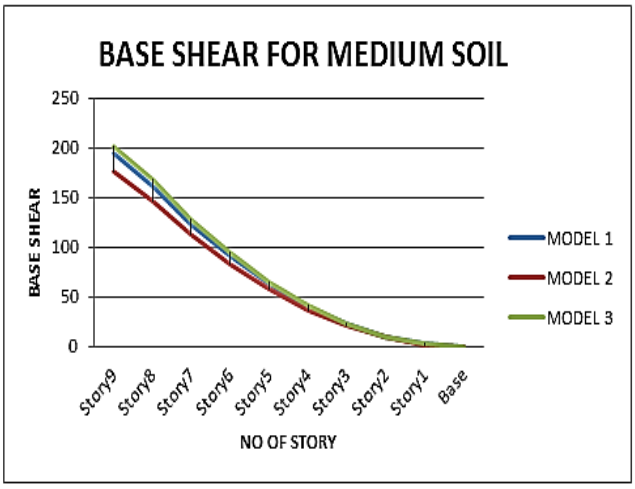
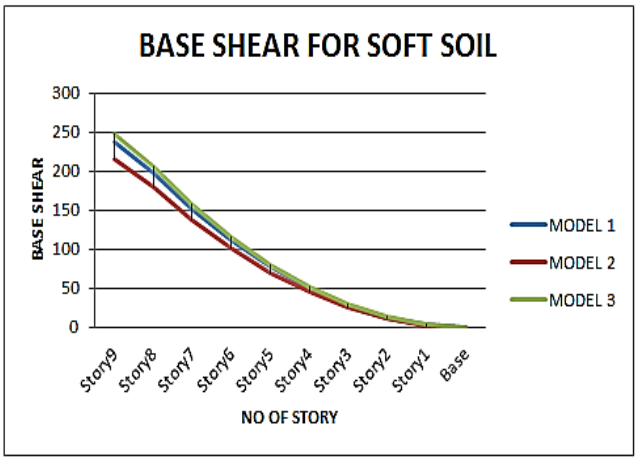
• The graph shows the base shear for hard soil for MODEL 1, 2 and 3. Model 2 shows minimum values of baseshear, model 1 gives higher value as compared to model 2 and model 3 gives the maximum value for base shear.



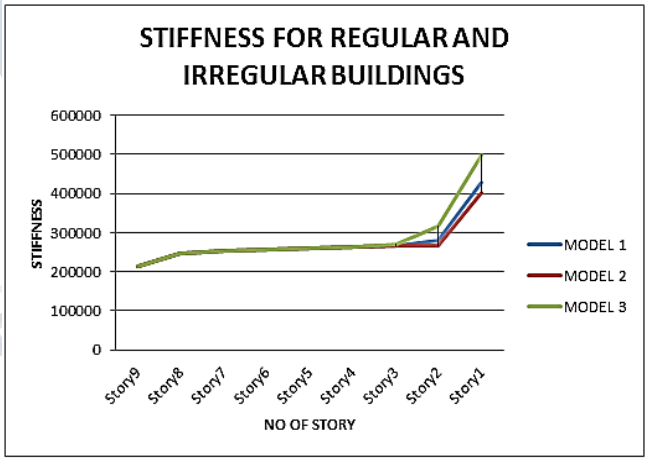
• The graph shows the base shear for medium soil for MODEL 1, 2 and 3. Model 2 shows minimum values of base shear, model 1 gives higher value as compared to model 2 and model 3 gives the maximum value for base shear.



• The graph shows the base shear for soft soil for MODEL 1, 2 and 3. Model 2 shows minimum values of base shear, model 1 gives higher value as compared to model 2 and model 3 gives the maximum value for base shear.



• The graph shows the story stiffness for MODEL 1, 2 and 3. Model 3 gives the maximum values of stiffness, model 1 gives a lesser value as compared to model 3 and model 2 gives the least value for story stiffness.



III. CONCLUSIONS

• Model 2 i.e. no slab on story 1 gives the minimum values of base shear for all the three types of soil i.e. hard ,medium and soft soil , model 1 i.e. regular building gives a higher value of base shear as compared to model 2 and model 3 i.e. double slab on story 1 gives the maximum value of base shear.

• Model 3 i.e. double slab on story 1 gives the maximum value of story stiffness. Model 1 i.e. regular building gives a lesser of story stiffness as compared to model 3. Model 2 i.e. no slab on story 1 gives the minimum value for story stiffness .

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