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Seismic Analysis of Structure Considering Soil Structure Interaction

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Abstract: *In this paper we have made an attempt to study the soil structure interaction effect of different soil, on structural behavior of building. When Structure supported on mat foundationsubjected to seismic loads. During dynamic loading the consideration of actual support flexibility reduces the overall stiffness of the structure. Therefore it is necessary to study dynamic soil structure interaction. The main aim of the present study is to analyse the building that is supported on mat foundation for different soil conditions and compare the results of storey displacement,column end forces and bending moments in beams. The analysis of the soil structure is done by using STAAD PRO. analysis package.*
Keywords: *Soil Structure Interaction, Subgrade Modulus, Story Drift.*

I. Introduction

The scarcity of land compels engineers to constructbuildings at locations with less favorable geotechnicalconditions in seismically active regions. Numerous midrisebuildings have been built in earthquake prone areasemploying different types of foundations. In the selectionof the foundation type for the mid-rise buildings, severaloptions such as shallow foundation, pile foundation, orpile-raft foundation, might be considered by designengineers to carry both gravity and earthquake loads.However, different types of support assumptions behave differentlyduring the earthquake considering the soil-structureinteraction (SSI) that may influence the seismic behaviorof the superstructure.

II. PROPOSED WORK

The aim of this work is to analyse structure considering soil structure interaction under seismic loads.To analyse the structure considering fixed base and spring support with a10-story structure. The effect of different soil types are considered in the form of soil springs Proposed by WINKLER .Three Subgrade Modulus values are considered for the interpretation of different types of soils to identify the effect of SSI with respect to, story drift, forces on column and beams.To identify the bestpractice for the consideration ofsupports.

III. MODELLING

In this study 10-storied RCC building is analysed with two support conditions i.e fixed support and other is Elastic mat supported on soil springs. A mat with thickness 850 mm is considered, resting on three types of subgrade modulus. The structure is analysed and designed for earthquake forces using Response Spectrum method. Details of modeling are given below.

No. of Storey	10
Storey Height	3m
Spacing in X-direction	6m
Spacing in Y-direction	6m
Slab	150 mm
Live Load	3kN/m2
Roof Live	1.5 kN/m2
Floor Finish	1kN/m2
Material	M30, Fe 500
R= 5 , I=1,Zone IV	

Table 1: Details of modeling.

Type of soil	Soft	Medium	Hard
Subgrade Reaction kN/m3(K)	10000	45000	95000

Table 2: Subgrade modulus .

Model 1 :Basic Fixed support model.
Model 2 :K-10000 soft soil spring.
Model 3 : K-45000 medium soil spring.
Model 4 : K-95000 hard soil spring.

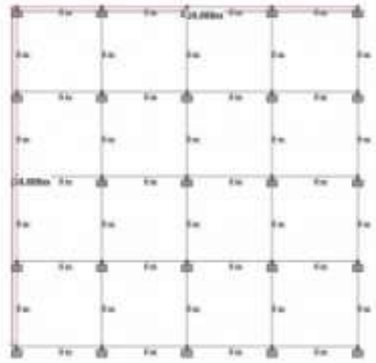

Figure 1: Basic plan with fixed support.

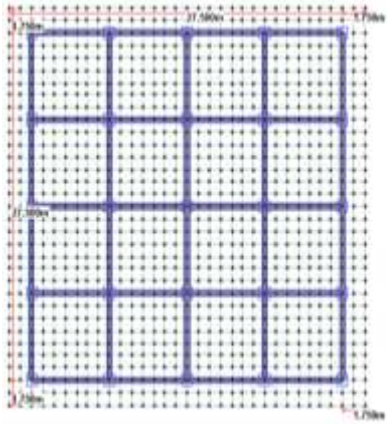

Figure 2: Plan with elastic mat supported by soil springs.

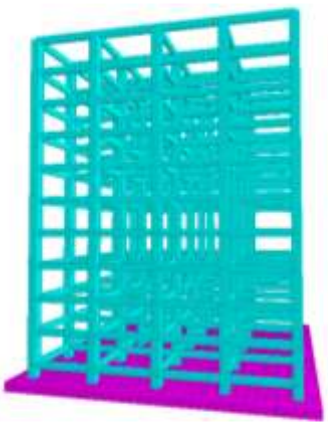

Figure 3: 3D view of elastic mat.

IV. RESULTS AND DISCUSSION

a) **Story Displacements:** Fig.4 shows Story displacements for various support conditions.For soft soils very significant increase in displacements of the structureis seen when subjected to lateral forces due to earthquake. Deflection at the top floor was 35 % more for structure supported on soft soils than that of fixed supports.Whereasfor medium and hard soil 22% to 24 % more deflections are observed.

b)

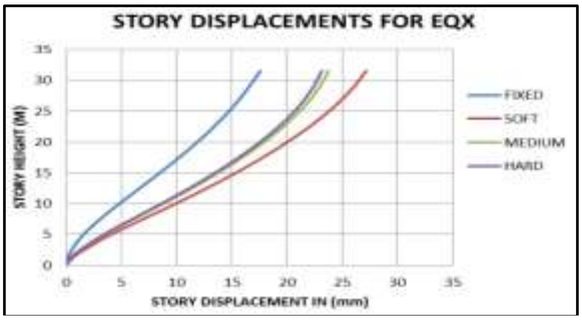

Figure 4: Story displacements for EQX

c) **Column end moments:**Fig.5 shows the bending moments at the base of the columns under gravity loadings show a greater increase for soft soils as compared to the medium and hard soil. As the stiffness of the soil strata increased, structure behavior became closer to that observed for rigid supports.

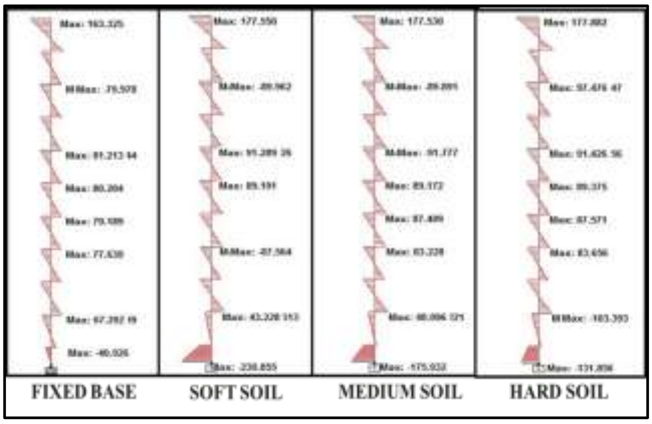

Figure 5: column end moments for 1.5(DL+LL)

d) **Bending moments in beams :**Fig.6 shows seismic forces, magnitude of bending moments in the outer beams varies with the increase in modulus of subgrade reaction.

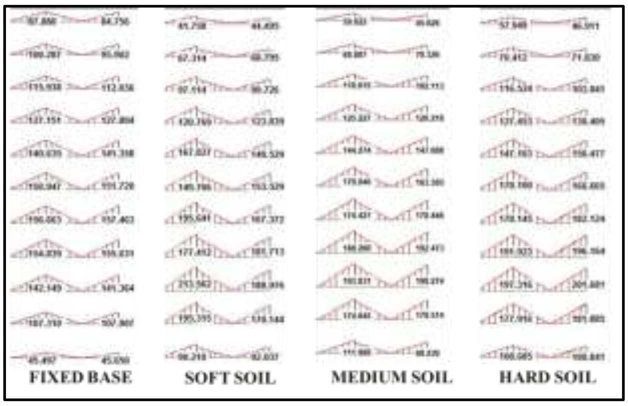

Figure 6: bending moments in outer beams for (EQX).

V. Conclusions

The response spectrum analysis of 10-stored building considering soil structure interaction concludes as follows:

1) Consideration of realistic support condition changes the column beams forces in the structure.

2) The relative displacements between successive floors are less for structure on soft soils.
3) The structure on soft soil deflects as a whole body.
4) The effect of SSI in soft soils is more as compared to medium and hard.
5) As the stiffness of the soil strata increased, structure behavior became closer to that observed for fixed supports.

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