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Building with foundation resting on soft soil

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Abstract: *The response of the structure to the earthquake depends on three factors, the structure itself, the foundation, and the soil underlying the foundation and around it. A building that has multiple floors is a multi-story structure. The building must be durable and efficient and will serve many years without exposing any failures. So this paper aims to analyze the structure resting on soft soil with ETABS software to get load combinations, support reactions, and reinforcement of column and footing. There is CSI SAFE software that is taken into consideration for analyzing the foundation of the structure. In this paper we are going to design for the two cases i.e., 1) Raft foundation and 2) Raft-pile foundation.*

Keywords: Etabs, csi safe, soft soil, Raft foundation, pile-raft foundation, soil-structure interaction.

1. INTRODUCTION

Most civil structures contain some type of structural element that makes direct contact with the ground. When external forces, such as earthquakes act on these systems the structural displacements and the ground displacement do not remain independent of each other. The process by which soil response influences structural movements and affects soil response is called soil-structure interaction (SSI).

Soil-structure interaction basically can be defined as a collection of phenomena in the response of structure resulting from the flexibility of soil under the foundation as well as in the response

of soils caused by the presence of structures. A complete soil foundation-structure system is composed of a frame in the superstructure, its foundation and the soil on which it rests.

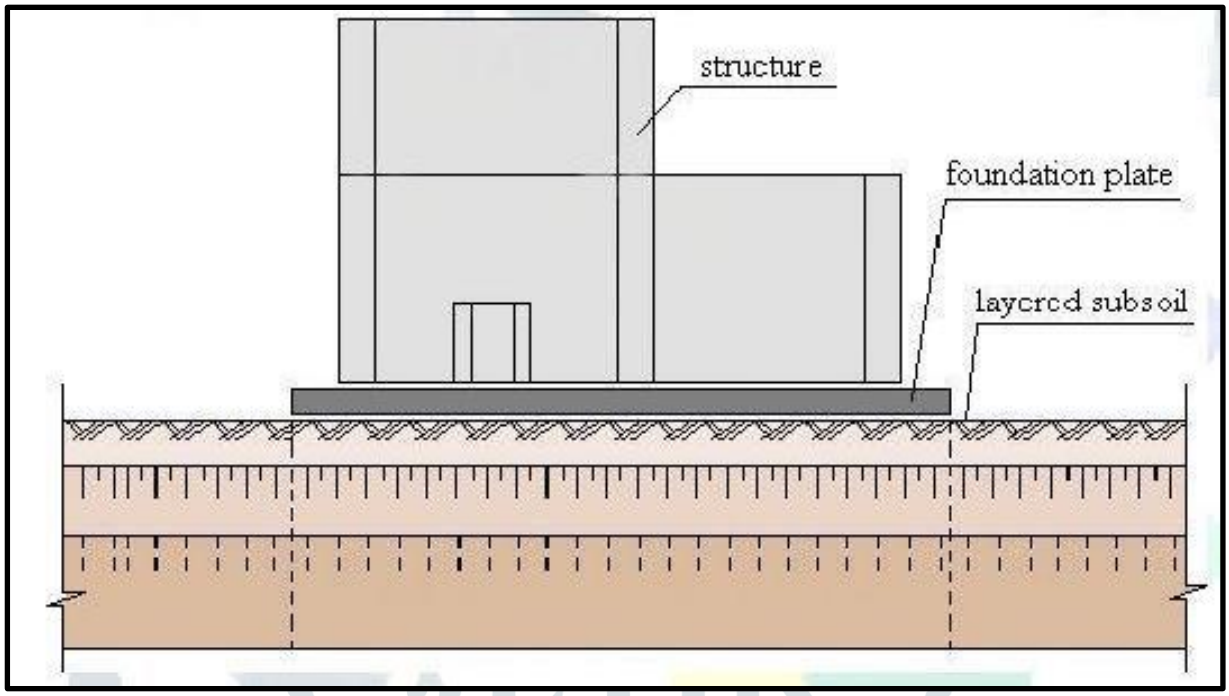

Figure-1 : Interaction between structure , foundation plate and soil

The response of a structure to earthquake shaking is affected by interactions between three linked systems: the structure, the foundation, and the soil underlying and surrounding the foundation. Both the axial forces and the moments in the structural members may change with the differential settlement (caused due to soil properties) among various parts of the structure. Evidence from past earthquakes has demonstrated the devastating effect of soil liquefaction on the seismic response of buildings. Thus, the response of buildings resting on soft ground and subjected to earthquake effects has received considerable attention in the literature to produce better insights into the potential seismic response of buildings and hence to enhance design procedures.

A. Aim of the study:

To analyze and design Building (G+23) with a foundation resting on soft soil**.**

B. Objective Of the Study:

1. To design and analyze the building foundation resting on soft soil with the help of ETABS.
2. To design and analyze the foundation in CSI SAFE.
3. To check the stability of structure with seismic load in seismic zones IV.
4. To understand the effect of soil-structure interaction.
5. To find the effect of SSI on structure and soil.

2. LITERATURE SURVEY

Title	Name of Author	Year	Finding
Soil Structure Interaction Of Highrise Building Resting on soft soil	Mao-Guang Yue, and Ya-Yong Wang	2009	The study is on the influence of soil structure interaction on the super structure are studied with **ABAQUS** procedure. However, seismic response of structural member may be amplified in some stories, so it is unsafe in such regions. Under bidirectional horizontal seismic excitations, the larger reduction factor shall be taken as the influences of field nonlinearity on seismic response at the two directions are different.
Effects of Soil Plasticity on Seismic Performance of Mid-Rise Building Frames Resting on Soft Soils	Behzad Fatahi and S. Hamid Reza Tabatabaiefar	2014	In this study, the effects of Plasticity Index (PI) variation on the seismic response of mid-rise building frames resting on soft soil deposits is investigated. The frame sections are modeled and analyzed, employing a finite difference method adopting **FLAC 2D** software under two different boundary conditions: (i) fixed base (no Soil-Structure Interaction), and (ii) flexible base considering soil-structure interaction.
Structural Analysis of a Multi-Storeyed Building using ETABS for different Plan Configurations	Abhay Guleria	2014	It mainly emphasizes the structural behavior of multi-storey building for different plan configurations like rectangular, C, L, and I-shape. Modeling of 15-storeys R.C.C. framed building is done on the **ETABS**

			software for analysis. Post analysis of the structure, maximum shear forces, bending moments, and maximum storey displacement are computed and then compared for all the analyzed cases.
Analysis And Design Of A Multi-Storied Residential Building Of (Ung-2+G+10) By Using the Most Economical Column Method	M.Mallikarjun, Dr .P V Surya Prakash	2016	The present project deals with the analysis and design of a multi storied residential building of (ung-2+g+10) by using most economical column method. The dead load &live loads are applied and the design for beams, columns, footing is obtained etabs with its new features surpassed its predecessors, and compotators with its data sharing. The analysis and design for the structure done by using a software package etabs.in this project multistoried construction, we have adopted limit state method of analysis and design the structure.
Numerical Modeling of Shallow Foundation on Liquefiable Soil Under Sinusoidal Loading	Amrendra Kumar and Sunita Kumari	2018	Most of the structures (Light or Heavy) in seismic areas are resting on saturated soil and are prone to liquefaction behavior. A computer code based on the finite element method is developed in **FORTRAN 90** to simulate a surface footing resting on a loose liquefiable soil deposit. The results show that settlement of foundations increased with the increase of soil permeability i.e. at higher permeability, the maximum settlement in the

			vertical direction and lateral direction
Effect of soil–pile–structure interaction on seismic behaviour of RC building frames	J. Visuvasam & S.S. Chandrasekaran	2019	The main aim of this study was to investigate the effects of soil–pile–structure interaction on the earthquake behaviour of reinforced concrete building frames. Equivalent static analysis was carried out using a direct method of approach. A Geotechnical finite element program **PLAXIS 3D** was used for this numerical investigation. Building types ranging from low-rise to high-rise (5 storeys, 10 storeys and 15 storeys), relative densities of sandy soil ranging from loose to dense (30%, 50% & 70%) and spacing of piles ranging from close to large (2D, 4D and 6D) were the parameters considered for this study. Hence, a suitable selection of pile group configurations is necessary for the proper analysis and design of building structures. (It is also recommended to perform dynamic analysis on various other structural models considering the various soil types and pile group configurations.)
Accumulative Stability Increment of Multi-Storied Building Rested Over Soft, Medium, and Hard Soil	Sunil Rathore, Ankit Pal, & Arvind Vishwakarma	2020	The seismic analysis of the building is main aim of this study. This paper is based on the study of different research paper of different researchers which are used different soil types. On the bases of hard, medium and soft

			soil different researchers used in various building construction so that it get reaction against the lateral loads. The stability is more in hard soil and moderate in medium soil and the foundation adoptability is more required in soft soil.
Soil Structure Interaction Analysis on a RC Building with Raft foundation under Clayey Soil Condition	D S Prakash, M Roopa	2020	This study is mainly concentrated on in situ clayey soil conditions. The RC building considered to analyse SSI is an apartment of G+12Storey with an elevation of 40.15m and with the plan shape of 28.2mX16.1m proposed at Mambakkam, South Chennai, Tamil Nadu state, India. The study has used the finite element tools ETABS 9.7.4 for modeling and **SAP2000** ver17 for SSI analysis.
Dynamic Analysis On Multistoreyed Building Using Etabs	J Selwyn Babu, V.Mary Florence, J Rex	2020	In this investigation G+ 9 multistoried private structure is dissected in zones II and IV with sidelong stacking impact of seismic tremor utilizing reaction spectra method. This undertaking is structured according to IS CODES-IS 1893-Section 2:2002, IS 456-2000. From the examination story displacement, story floats, story shear, story solidness and base responses esteems are assessed for correlation.
Soil-Structure Interaction on Framed Structure using ETABS	Rahul Raghunath Kharade and	2020	Seismic analysis is carried out for reinforced concrete moment resisting building frame G+12

	M V Nagendra		Storey, which is considered for the present study to investigate SSI effects on tall buildings. Soil-Structure Interaction, basically can be defined as a collection of phenomenon in a response of structure resulted from the flexibility soil under the foundation as well as in the response of soil caused by the presence of structure.
Seismic soil structure interaction of reinforced concrete frame building supported on foundations	Bhuvana Rekha, Lingeshwaran N, Sunny Agarwal, and Sateesh Madavarapu	2021	They investigated the influence of soil structure interaction on RC frame building with seismic excitations. **SAP2000** Software is used to model and analyze the foundation-soil-structure system to study the stress on soil and framed structure in the presence of SSI. SSI effects are higher than the regular approach if we include the SSI effects in our analysis and design of the structure to get a safety design.
Analysis and Design of G+12 Storey Reinforced Concrete Building Using ETABS	P. Vinoth, Irfan Alam, Abdul Rehman, Mohammad Raiyan, Gauhar Imam, Mohd Ashar Zubair	2022	The following findings are drawn from the analysis and design of G+12 story buildings: 1) Our project entails the construction of an earthquake-resistant structure that is also cost-effective. 2) The previous dimensions of the beam and columns were B@300mmX600mm and C@300mmX600mm, respectively; however, after analysis, only the column fails. Thus the dimensions of column

			were altered to C@450mmX600mm, which is also more cost effective. 3) The seismic study was performed using ETABS software and personally confirmed according to IS 1893-2002. 4) In software analysis, the value of reaction force and loads increases gradually from to the roof top floor to the ground floor if we come down.

IS Code Used

1. IS 875:2015 (Part 1, 2, 3, 4, & 5)
2. IS 1893: 2016
3. IS 800:2007
4. IS 456:2000

3. CONCLUSION

The design and analysis of the building with a foundation in ETABS are conducted to study the behavior of load combinations on structure and foundation. As the building is resting on soft soil the combinations of the pile-raft foundation are recommended and analyzed to study the structure behavior.

And the design and analysis of the foundation in CSI SAFE are conducted to study the behavior of soil-structure interaction. Here also the combinations of the pile-raft foundation are analyzed to study the soil behavior.

4. REFERENCES

1. Rahul Raghunath Kharade, M V Nagendra (2020) “Study of Soil-Structure Interaction on Framed Structure using ETABS” International Journal of Engineering Research & Technology (IJERT) Volume: 07 Issue: 08.

2. Mr. Ayush Jain, Prof. Vishal Sepate (2022) "Review on Analysis of Multi-Storey Framed Structure Using ETABS in various zones considering Soil-Structure Interaction" International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume: 10 Issue: V.
3. Bhuvana Rekha, Lingeshwaran N, Sunny Agarwal, and Sateesh Madavarapu (2021) "Seismic soil structure interaction of reinforced concrete frame building supported by foundations" IOP Conference Series Materials Science and Engineering 1136(1)
4. D S Prakash, M Roopa (2020) "Soil Structure Interaction Analysis on an RC Building with a Raft foundation under Clayey Soil Condition"
5. Abhay Guleria (2014) "Structural Analysis of a Multi-Storeyed Building using ETABS for different Plan Configurations" International Journal of Engineering Research & Technology (IJERT) Vol. 3 Issue 5.
6. Amrendra Kumar & Sunita Kumari (2018) "Numerical Modeling of Shallow Foundation on Liquefiable Soil Under Sinusoidal Loading" Springer International Publishing AG, Geotech Geol Eng 37, 517–532 (2019).
7. Mao-Guang Yue, and Ya-Yong Wang (2009) "Soil Structure Interaction Of Highrise Building Resting on soft soil" ResearchGate Vol. 13, Bund. D.
8. Behzad Fatahi and S. Hamid Reza Tabatabaiefar (2014) "Effects of Soil Plasticity on Seismic Performance of Mid-Rise Building Frames Resting on Soft Soils" SAGE journals, Advances in Structural Engineering Vol. 17 No. 10.
9. Kaveri, Guramma, Muttamma, Neelamma Kawati, Saksheshwari (2019) "Analysis Of A Multi-storied Building In Different Soil Conditions With DifferentSeismic Zones Of India" SSRG International Journal of Civil Engineering, Volume 6 Issue 5.
10. J Selwyn Babu, V. Mary Florence, J Rex (2020) "Dynamic Analysis On Multi storeyed Building Using Etabs" ResearchGate Volume: 63 Issue: 2s.
11. J. Visuvasam, & S. S. Chandrasekaran "Effect of soil–pile–structure interaction on seismic behaviour of RC building frames" Innov. Infrastruct. Solut. 4, 45 (2019).
12. Nirmal S. Mehta, Urmi D. Modi, Parth R. Patel, Rutvik M. Prajapati "Analysis and Design of Multi Storey Residential Building Using ETABS" International Journal of Emerging Technologies and Innovative Research (www.jetir.org), ISSN:2349-5162, Vol.5, Issue 11.
13. https://1library.net/title/case-study-seismic-analysis-irregular-structure