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# Soil Interaction Effect in Multi-storied Building with Cohesive and Non Cohesive Soil

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**Abstract:** The main aim of this project is based on comparing the effect of earthquake on building structural systems having cohesive and non-cohesive soil media. The project starts with abroad note of studying for fixed base and soil interaction.

**Keywords:** Seismic analysis, Earthquake excitation, Super moment resisting frame, member forces, joint displacement, support reaction, storey drift, E-tab 2016

## I. INTRODUCTION

Earthquake is known to be one of the most destructive phenomenon experienced on earth. It is caused due to a sudden release of energy in the earth's crust which results in seismic waves. When the seismic waves reach the foundation level of the structure, it experiences horizontal and vertical motion at ground surface level. Due to this, earthquake is responsible for the damage to various man-made structures like buildings, bridges, roads, dams, etc. It also causes landslides, liquefaction, slope-instability and overall loss of life and property. Most of the time earthquakes are caused by the slippage along a fault in the earth's crust. When the fault ruptures in the earth's crust, the seismic waves will travel away from the source known as focus, in all direction to the ground surface. As they travel through different geological materials, the waves are reflected and refracted. Throughout the whole journey from the bedrock to the ground surface, the waves may experience amplification Soil-structure interaction (SSI) analysis evaluates the collective response of three linked systems: the structure, the foundation, and the soil underlying and surrounding the foundation. Problems associated with practical application of SSI for building structures are rooted in a poor understanding of fundamental SSI principles.

### A. Advantages of E-tab

- 1) Easy and quick model creation for any type of structure.
- 2) Creation of 3D model with utilization of plan and view.
- 3) Automatic consideration of self-weight of material.
- 4) Automatic creation of seismic load and wind load.
- 5) Load combination as per your defined building code is also automated.
- 6) Easy report and documentation

### B. Loads And Load Combination

- 1)  $1.2(DL+LL\pm(EQX\pm 0.3EQY\pm 0.3EQZ))$
- 2)  $1.2(DL+LL\pm(EQY\pm 0.3EQX\pm 0.3EQZ))$
- 3)  $1.5(DL\pm(EQX\pm 0.3EQY\pm 0.3EQZ))$
- 4)  $1.5(DL\pm(EQY\pm 0.3EQX\pm 0.3EQZ))$
- 5)  $0.9DL\pm 1.5(EQX\pm 0.3EQY\pm 0.3EQZ)$
- 6)  $0.9DL\pm 1.5(EQY\pm 0.3EQX\pm 0.3EQZ)$

Loads considered: Dead load: the load due to its self-weight.

Live load: for residential building live load is taken as KN/m<sup>2</sup>

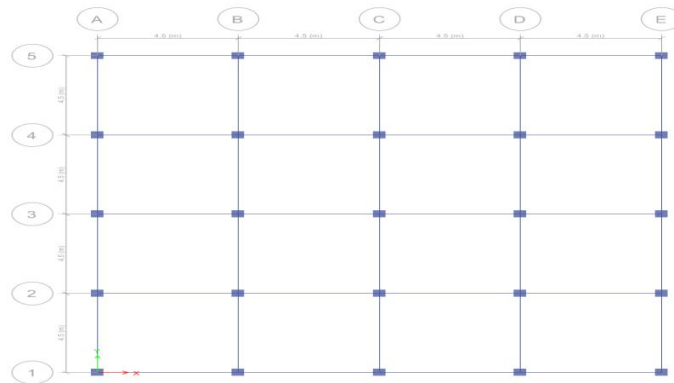
Seismic load: the load due to acceleration response of the Ground to the super structure

### C. Model Detail

Model 1- Eleven storey(G+10) building with fixed support and cohesive soil media.

Model 2 - Eleven storey(G+10) building with soil structure interaction and cohesive soil media.

Model 3- Eleven storey(G+10) building with fixed support and non-cohesive soil media.



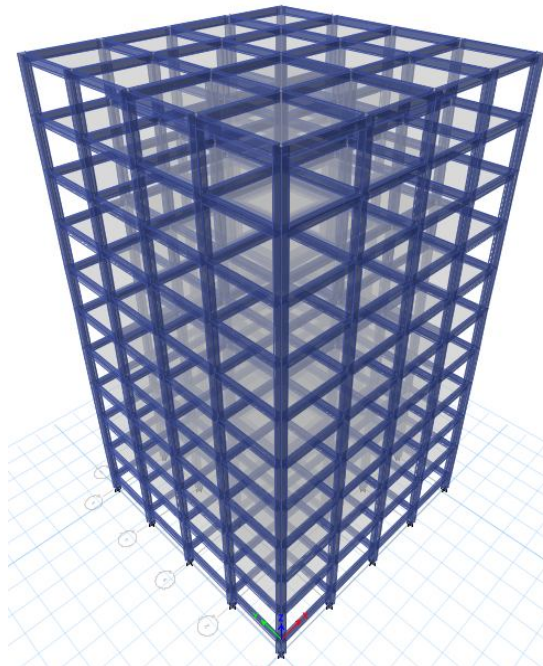
Model 4- Eleven storey(G+10) building with soil structure interaction and non-cohesive soil media

## II. CALCULATION OF LOADS

According to IS code: For dead load calculations,  
 Unit weight of brick wall = 20 KN/m<sup>3</sup>,  
 Unit weight of RCC= 25 kN/m<sup>3</sup>,  
 Floor finish =1kN/m<sup>2</sup> on each floor 3 and (1.5kN/m<sup>2</sup>) on roof.

### A. Typical elevation of G+10 building

Fig 1- Typical floor building



## III. CONCLUSION

E-tab contains number of parameters which are designed as per IS: 456(2000). Beams are designed for flexure, shear and torsion. Design for Flexure: Maximum sagging and hogging moments are calculated for all active load cases at each of the above mentioned sections. Each of these sections are designed to resist both of these critical sagging and hogging moments. Where ever the rectangular section is inadequate as singly reinforced section, Doubly reinforced section is tried. Design for Shear: Shear reinforcement is calculated to resist both shear forces and torsional moments. Shear capacity calculation at different sections without the shear reinforcement is based on the actual tensile reinforcement provided by software.



### REFERENCES

- [1] IS: 1893 (Part 1) – 2016; “Criteria for Earthquake Resistant Design of Structures – general provisions and buildings”; Bureau of Indian Standards, New Delhi.
- [2] Jagadishponraj Nadar., 2015 The conventional design procedure involves the assumption of the fixity at the base of the foundation A. B. M. Saiful Islam<sup>1\*</sup>, M. Jameel<sup>1</sup>, M. A. Uddin<sup>1</sup>
- [3] Dange Swati., 2016 Response of a structure subjected to gravity and lateral loads depends on the boundary conditions assigned at the base of structure in numerical modelling.
- [4] B. Ravi Sankar, 2016 The main aim of this project is to design the size of footing for cohesive and non-cohesive soils
- [5] Basavanagowda G. M., 2017 In the last few decades, it has been perceived that Soil Structure Interaction (SSI) changed the reaction attributes of a structural system due to huge and firm nature of structure and frequently
- [6] S.A.Rasal The effect of soil structure interaction on response of the three storeyed building frame.
- [7] Janardhan Shanmugam 2015 The effect of soil-structure interaction on a four storeyed, two bay frame resting on pile and embedded in the cohesive soil is examined in this paper.
- [8] Preeti Codoori 2017 Study of Soil-Pile interaction is an important consideration in evaluating the seismic performance of pile-group supported structures.
- [9] Dheekshith K 2016 In the current circumstances, an attempt is made to
- [10] investigate the soil structure interaction when the erection is built on numerous under lying soil types
- [11] Chinmayi H.K 2013 During earthquake the behaviour of any structure is influenced not only by the response of the superstructure, but also by the response of the soil beneath.

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