PART 3 - STUDYING THE INFLUENCE OF SOILS UNDER THE FOUNDATION ON THE STRUCTURAL SYSTEM WHEN SUBJECTED TO SEISMIC LOADS

Simulate the impact of earthquakes on a high-rise building

Ha Thanh Tu

Faculty of Civil and Environment, Thai Nguyen University of Technology, Vietnam

Abstract

Big earthquakes with the intensity of earth-quaking from VII degrees to IX degrees were forecasted to be able to occur in Viet Nam. Therefore, studying to calculate the impacts of earthquakes on building structures in Viet Nam is very necessary. This paper studies the influence of different types of soil on the structural system of high-rise buildings when the building is subjected to earthquakes. After analyzing the model in Etabs software, the authors found that different types of ground for displacement, internal force difference up to 167%. At the same time, the authors also proposed a procedure to calculate the earthquake load-bearing structures using the response spectrum of many types of copper vibrations. It helps design engineers to easily apply structural calculations. To achieve the stated objective of the study. The overall content of this study is organized into four parts. Part 1: Methodological content; Part 2: Research model of a high-rise building in earthquake impact analysis; Part 3: Simulate the impact of earthquakes on a high-rise building; Part 4: Proposes a vibration calculation procedure for high-rise buildings.

Keyword: Earthquake, high-rise building, response spectrum, displacement, internal force.

1. INTRODUCTION

Earthquake calculation methods are interested in research by scientists around the world and are becoming more and more complete with increasing accuracy. Along with that trend, Vietnam has issued the standard TCVN 9386:2012 - design standard for earthquake-resistant buildings. This standard is based on EUROCODE - Design of structure for earthquake resistance standard. It has added and replaced some content to suit Vietnamese conditions. However, the guidance for design staff who can calculate the impact of earthquake loads is limited, especially earthquakes depend on seismic properties of each region.

2. SIMULATION RESULTS

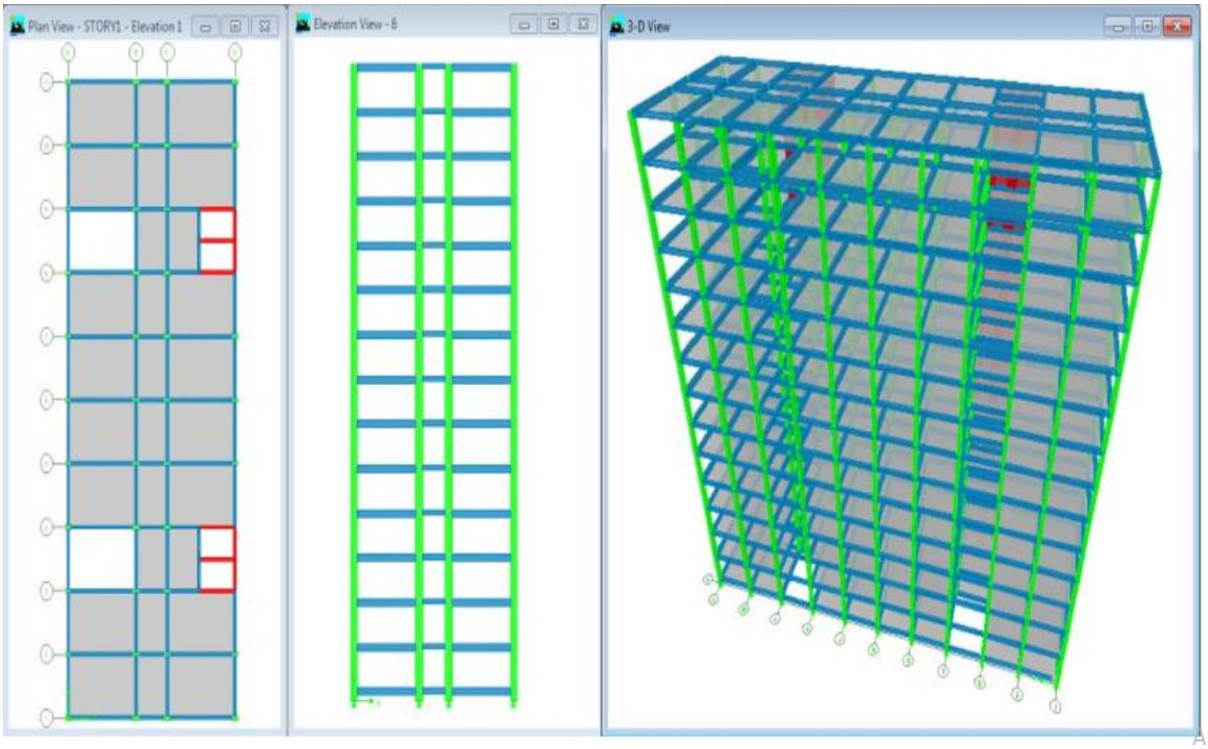

Figure 1 Building structure model in ETABS

Materials: Reinforced Concrete; Using durable grade concrete B25. Height of each floor: h_t= 3.3 (m); distance from foundation beam to foundation surface 1.5 (m).

Section: Floor S1 (120 mm), S2 (100 mm); Core thickness δ= 250 mm; Beams D1,2,3 (250x400) mm, D4 (250x550) mm; Column C1 (300x600) mm, Column C2 (300x700) mm.

Calculated load:

- Static loads due to the weight of the structure itself: Floors, beams, columns, walls, declared for ETABS v9.2 software to calculate automatically.
- Static load of floor structural layers: g_{tt} = 1.1 (kN/m2).
- Static load due to walls built on beams: g_t = 11.48 (kN/m).
- Floor live load: S1 (p_{tt}= 2,4 kN/m2); S2 (p_{tt}= 3,6 kN/m2)
- Earthquake load: importance factor γ = 1; behavior coefficient q= 3.9.

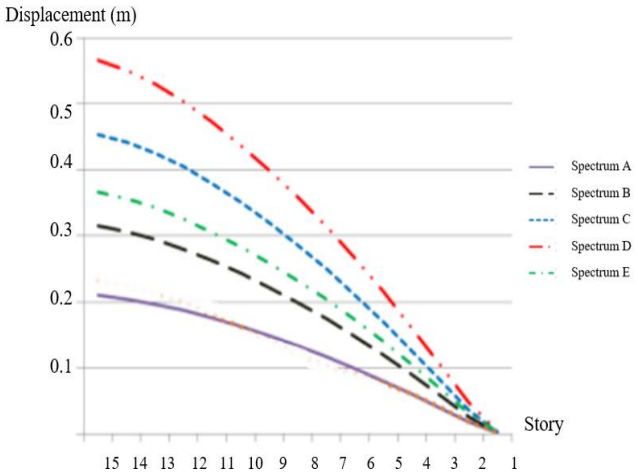

Figure 2 K6 frame displacement when analyzing earthquakes with different types of ground

Combination of internal forces of frame column K6 (in the X direction)

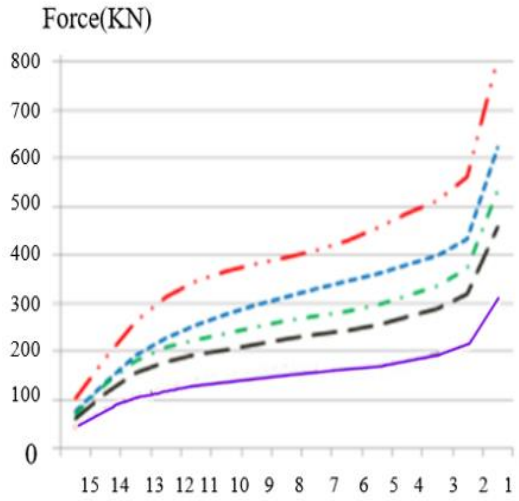

Figure 3 The shear force of column A of K6 frame when analyzing earthquakes with different types of *ground*

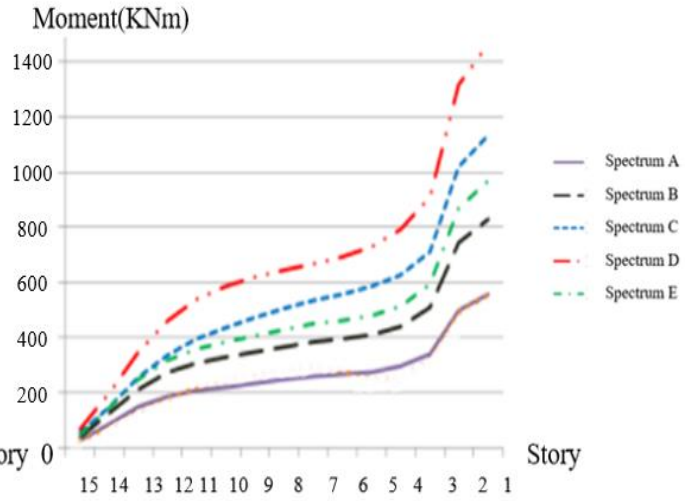

Figure 4 Moment of column A of K6 frame when analyzing earthquakes with different types of ground

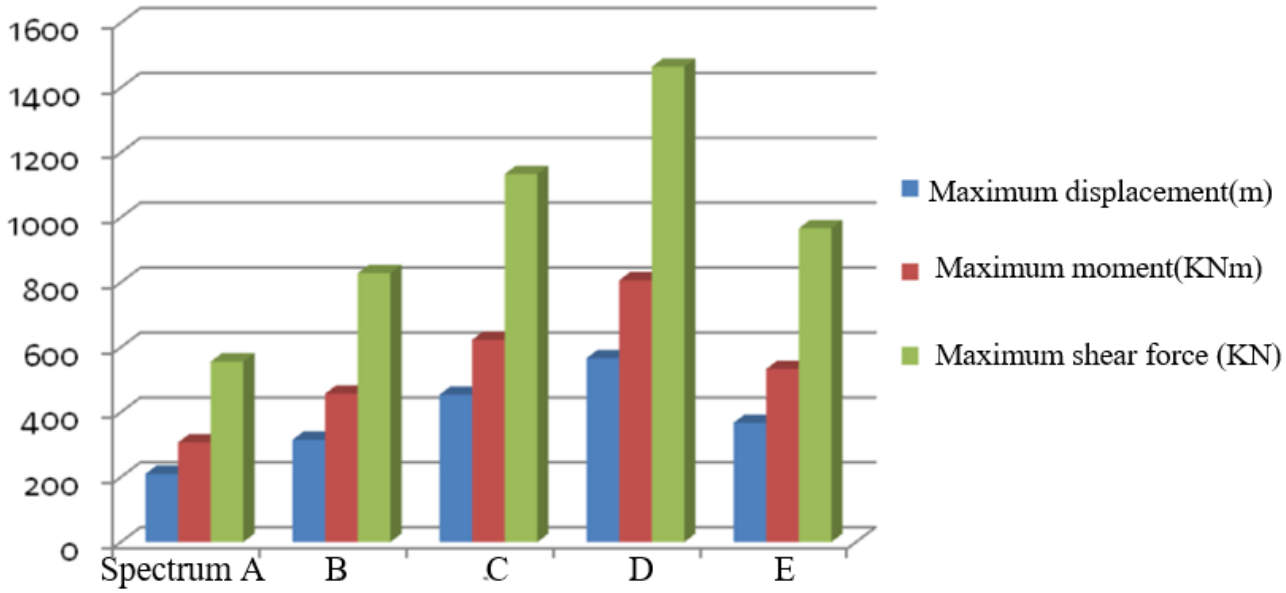

Figure 5 The largest earthquake consequences when analyzing with soil types

Analysis of earthquakes by the method of response spectrum of many vibrations to evaluate the influence of different types of ground on the structure of the building when subjected to earthquakes. Combination of frame displacement K6 (in the X direction).The results of earthquake analysis according to the time-history method and the multi-form response spectrum method on the ground type A according to TCVN 9386:2012 have the largest difference of 15%.The ground at the bottom of the structure has a great influence on the earthquake impact on the structure. Earthquake consequences: displacement, internal force of the

structure when considering different types of ground soil A, B, C, D,

3. CONCLUSIONS

The ground at the bottom of the foundation has a great influence on the impact of earthquakes on the structure. The soil type of rock, loose soil in the compact state, and clay in the hard state with great thickness will be less affected by earthquakes than the soil in the porous state (medium compaction) or cohesive soil in the soft state. (medium tight). Consequences of earthquakes: displacement, internal force of the structure when analyzed with different types of ground, the difference is up to 167%.

4. ACKNOWLEDGEMENT

This work is supported by Thai Nguyen University of Technology, Vietnam.

REFERENCES

[1] Nguyen Le Linh (2011), Theoretical basis for earthquake-resistant construction. Science and Technology Publishing House, Hanoi.

[2] Nguyen Le Linh (2007), Earthquake and earthquake-resistant construction design, Construction Publishing House, Hanoi.

[3] Nguyen Tat Tam (2010), Calculation of reinforced concrete high-rise buildings with hard floors under the impact of earthquakes according to TCXDVN 375-2006, Master thesis, Hanoi University of Architecture.

[4] Le Thanh Huan (2007), Structural design of high-rise buildings, Construction publishing house, Hanoi.

[5] TCVN 9386:2012. Design of earthquake-resistant structures, Construction Publishing House, Hanoi, 2006.