3rd International Conference on Applied Researches in
Structural Engineering
and Construction Management
Sharif University of Technology - June 2019

Investigation of seismic behaviour in restrained deep excavation by the nailling system by finite element method

Mahdi maleki[1]*, Ali nabizadeh[2]

1- Master of Science of Civil Engineering-Geotechnics, Industrial University of Amirkabir, Tehran, Iran
2- Faculty Member of Civil Engineering, Industrial University of Amirkabir, Tehran, Iran

mahdi1793@aut.ac.ir

Abstract

The stabilization of deep excavation by using soil reinforcement method by anchors is one of the important issues in geotechnical engineering. The highly suitable performance of nail walls during strong ground movements and as well as flexibility than to other guard structures, such as retaining walls, makes it more obvious that this system should be examined under earthquake effects. Therefore, it is important to study the factors affecting the stability and deformation of the walls of the reinforced by this method under seismic forces. Soil resistance parameters and consideration of the proper values for length, angle and distance between the nails have a direct effect on the stability and deformation of the nail wall. In this study, by studying a case study and using finite element modelling, the effects of a site with two different soil types, one with strong geotechnical characteristics (hard soil), and another with less geotechnical characteristics, on the performance of the restrained wall with Nailing method using dynamic seismic analysis is examined. The results of this study show that taking into account the proper values for the nails parameters (angle, length and distance between the nails) has important implications for design safety and deformation control.

Keywords: Nailing, Dynamic Seismic Analysis, Finite Element Method

1. INTRODUCTION

The analysis of structures under the influence of earthquakes is mainly based on the quasi-static and dynamic analysis method. The quasi-static method, taking into account the effect of vibrations from the earthquake as vertical and horizontal accelerations and applying vertical and horizontal forces, performs seismic analysis of the structures, but this method has defects in comparison with the dynamic analysis method, One, in a quasi-static method, static forces in a constant direction constantly affect the structure, while the actual seismic forces are cyclic and limited in time and vary with time. These errors make it more preferable to use the dynamic analysis method than to the quasi-static method, which is very conservative. Dynamic analysis means any dynamic analysis such as earthquake, vibratory foundation, knock, explosion, etc. For dynamic analysis, an equivalent linear method or nonlinear method can be used. an equivalent linear method for modelling common earthquakes, wave propagation in soil layers, and also for studying the dynamic interaction of soil-structure is a convenient and acceptable method. Mainly the parameters considered are in the dynamic analysis of the shear modulus and the damping coefficient. The shear modulus in small strains can be determined by simple geophysical experiments, however, laboratory experiments have to be performed to define the shear modulus in large strains. In this method, earthquake loading can be described as acceleration history, velocity history, or displacement history. To investigate seismic dynamic analysis, methods should be used to simulate the earthquake-time history that the finite element method is one of these methods. One of the advantages of the finite element method is that due to its detailed component and modelling it can be geometrically and geophysically customized for any part of the structure. It can also provide a lot of information, including time variations in displacement, velocities, accelerations, moment-to-moment variations in stress, deformation and variations in the properties of materials and the local response to damping. The soil trenches tend to move downward after excavating and breaking tension balance. From the static point of view, slip occurs when thrust forces overcome the forces of resistance that derive from the shear strength of the soil at the sliding surface [1]. In the control of the safety and stability of the trenches, the shear stresses created along the most critical and most likely slip surface should be calculated and compared with the shear strength of the soil. There are various methods for the stabilization of trenches, among which the nailing method is one of the most common methods used to stabilize the walls and It is also used to