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Research

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Effect of soil behavior model on drilling response of anchor-reinforced excavation

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ABSTRACT

Although The reinforced elements such as nailing and anchor have been widely used for the stability of excavation and trench because of not taking up a large space, improved soil properties by injection, greater safety, and the possibility of being used as a permanent retaining structure. Due to the complex behavior of reinforced excavation, the stability analysis of reinforced excavation is performed by the finite element method. Some factors such as boundary interval, dimensions and type of elements, and type of behavior model of materials affect the numerical results. Due to the complex behavior of the soil stress-strain, influence from stress path and loading history, and the existence of groundwater, different behavior models have been proposed to simulate the materials. In this study, the effect of the soil behavior model on the response of anchored excavation was investigated. For this purpose, using the finite element method in the plane strain conditions, the excavation reinforced with the anchorage system was simulated for different geometrical conditions, and the results of the excavation response were compared for the Mohr-Coulomb, Drucker-Prager, and modified Cam-Clay behavior models. In the shallow excavation, it was found that the Mohr-Coulomb behavior model has the least displacement, and the Drucker-Prager behavior model has the largest lateral displacement. The Drucker-Prager behavior model should be considered as a reliable criterion for the design and control of the excavation because of the greater results regarding the lateral displacement of excavation and generally, excavation deformation.

Keywords: reinforced excavation, lateral displacement, Mohr-Coulomb, Drucker-Prager, Cam-Clay

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1. INTRODUCTION

The excavation, design, and construction of retaining structures have been widely discussed in civil engineering and need to be explored and studied in terms of geotechnics, structure, materials, technology, implementation, and economic and social considerations. As a result, it can be stated that the selection of the appropriate method for solving the problems caused by the excavation depends on all the effective conditions and can be adopted in different ways under different conditions [1].

Anchorage is one of the important methods for the construction of retaining structures. This method is very similar to the nailing method, but it uses the strands, pre-tensioned tendons, and pre-tensioned cables instead of the reinforcement [2]. Sometimes, the pre-tensioned reinforcement can be used instead of strands. Unlike the nailing method in which the nails are not subjected to any force during the operation, the strands are subjected to tension in the anchorage method. The major advantage of