



Slope stability optimization using reinforcement by GEOSLOPE

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Abstract

This paper is studying slope stability evolutions by limit equilibrium (LE) methods and compared with the results from GEOSLOPE software. The LE based methods are compared based on the factor of safety (FOS) obtained from various conditions with simplified slope geometry and assumed input parameters. Specified slope is modeled in two various conditions; dry and wet, subjected to nailing and anchor reinforcements. Then, reinforced models are compared to the unreinforced samples in order to investigate the factor of safety of slope stability. Using reinforcements can increase the factor of safety of slopes to 30 percent. The comparative study among the LE methods showed that BSM is as good as M-PM for normal condition in circular shear surface (CSS) analysis whereas simplified Janbu (JSM) method gives the most conservative value of the FOS. It is suggested that using anchors in practice due to long fixity and high efficiency so as to increase slope stability.

Keywords: Slope Stability, Limit Equilibrium, Circular Shear Surface, GEOSLOPE

1. INTRODUCTION

One of the main problems and concerns in the field of civil engineering in the construction of structures are excavation, slope stability and adjacent buildings protection. In case of non-compliance using methods with the appropriate procedures to safeguard and slopes under construction, will result in irreparable damages. Risks arising from potential settlements and reduced bearing capacity and lateral displacements will cause cracks in adjacent structures. Based on the need for a thorough, safe and fast implementation for steep slopes and deep excavation construction, and maintenance of pit walls, GEOSLOPE is used for analyzing safety factors of slopes, embankment and excavation.

2. Reinforcing methods to increase safety factor in the stability of slopes

2.1 Nailing

Soil nailing includes situ reinforcement of excavation walls or installing steel bars within close distances to the slopes. Nailing elements are usually rebar or steel pipes that place in bore walls that was excavated and then grouting the borehole with cement slurry to transmit force between soil and reinforcement is performed. After installation of reinforcement, wall surface is covered with a shotcrete which usually consists of a lightweight and thin-layer. This method provides the ability to make a permanent armed cross in order to maintain the soil behind. Nailing is a reliable, rapid and affordable method for the stabilization of deep excavations, adjacent to other structures. Unlike some other methods such as structural stabilization operations, Nailing guard does not cause space limitation for construction operations.

Nailing method is based on reinforcement of soil mass by using sew with steel tensile nails in close intervals. The most important results of using nailing method are increasing the shear strength of the soil mass, limiting and controlling soil displacements in case increasing of soil shear strength in sliding surface due to increasing vertical force and of slip load reduction in failure and slip surface.