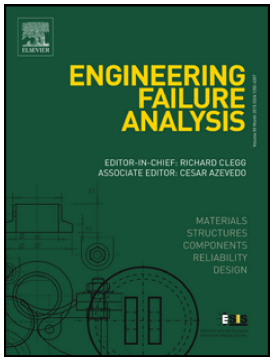

Investigation of design parameters of a failed soil slope by back analysis

İbrahim Ferid Öge

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Investigation of design parameters of a failed soil slope by back analysis

İbrahim Ferid Öge, PhD(*)

(*)corresponding author, feridoge@mu.edu.tr, +902522112208

Muğla Sıtkı Koçman University

Faculty of Engineering

Department of Mining Engineering

Muğla, TURKEY

Abstract

A soil slope instability occurred at the surface facility area of a mine site, which was successfully managed from occupational health and safety point of view, and no human or material loss was encountered. Three different excavation stages and consecutively occurring slope failures were investigated by back analysis. Limit equilibrium and finite element methods were employed for back analysis. The multiple failures enabled researchers to verify the parameters investigated by back analysis to be obtained from each failure. Extensive field and laboratory testing were available which constitutes a baseline for comparison. The performance of tests and several correlations proposed by other researchers were compared to the back analysis findings. The correlations that used the advantage of plasticity index and depth were found to be superior compared to the other test methods for this study. Moisture sensitivity, high groundwater level, and sampling are found to be some of the main reasons leading to soil slope failure.

Keywords: Slope failure, soil strength, back analysis, shear strength reduction, slope stability analysis

1 INTRODUCTION

Rock and soil slope stability draw the attention of researchers since it has significant practical importance, [1]. Slope failures are widely encountered and common problem for soil and rock excavations. Surface excavations are common for surface mining and mine structures like foundation excavation, road, or highway construction and levelling of an inclined topography for utilization. A slope failure may cause interruption of production in a mine as well as the human or material loss [2, 3]. For civil engineering works, a slope failure may necessitate rehabilitation with additional cost or interruption of construction leading to a delay in project management.

The task of slope stability analysis can be handled by employing several approaches. The most commonly applied methods are limit equilibrium and numerical methods. For strong rock conditions, discontinuities play a dominant role in the stability of the slope. Discontinuum approaches in numerical modelling are other commonly used analysis types [4] together with limit equilibrium methods for structurally controlled failure types that are also well known [5]. Heavily fractured and weak rock can be analysed by the methods proposed for soil slope stability analysis [6]. Depending on the soil formation and geology, circular or non-circular failure surfaces are exposed in soil slope failures. Soil slope stability analysis is commonly conducted by the method of slices which are classified under limit equilibrium methods [7, 8]. Continuum approaches are also well suited to handle numerical analysis of slope stability [9]. Shear Strength Reduction (SSR) method provides a factor of safety analysis for numerical analysis [10].