Stability Control of Narmab Dam and Sensitivity Analysis of Reliability Coefficients

Atanaz Bahrami Balfeh Teimouri [a], Ahad Bagherzadeh Khalkhali [b*]

[a] *Department of Civil Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran.*

[b] *Assistant Professor, Department of Irrigation and Drainage Engineering, College of Abouraihan, University of Tehran, Tehran, Iran.*

Abstract

Static and quasi-static stability analysis of embankment dams is of vital importance in different stages of dam's design, construction and operation. The stability can be studied using different techniques which are generally analyzed through Limit Equilibrium Method. Base on this main method, the critical slip surface is selected and the shear strength required to counter the slip at the selected surface is obtained and compared with shear strength of the soil at that surface in order to obtain confidence coefficient. In the present research, the Geo-studio Slope/w software that is a geotechnical software based on finite element method and is widely used in geotechnical field, is employed in order to analyze the stability of the body and foundation of Narmab dam in Golestan province. Narmab dam is a homogeneous embankment dam with a height of 60 m, crest length of 807 m and reservoir volume of 115 million cubic meters. The confidence coefficients provided by the software are compared to the permissible confidence coefficients. Moreover, the sensitivity of the confidence coefficients values to the changes in the effective factors, adhesion and internal friction coefficient, is analyzed. The analyses were performed on 8 values ($\pm 5, \pm 10, \pm 15, \pm 20$) of c and φ and the obtained values of confidence coefficients were compared. In addition, a comparison was made between different methods of stability analysis. According to the static and quasi-static conditions, Narmab dam is stable in all loading stages (End of Construction, First Impounding and Steady State Seepage and In general, only for the static conditions of the end of construction stage, the sensitivity of adhesion is greater than the angle of internal friction, but, in other conditions and stages, the sensitivity of friction angle has more effects.

Keywords: Stability; Coefficient of Confidence; Finite Element; Sensitivity Analysis; Geo-Studio Slope/W.

1. Introduction

The monitoring of safety and stability of embankment dams during construction, first impounding and operation are of particular importance. This is particularly important due to the damage caused by the slippage of the embankment slopes, because slippage of slope may lead to loss of human life and property or causes irreparable damage to a dam [1]. One of the most important and significant factors in the stability of embankment dams is the shear strength of materials used in the body and foundation of the dam. Shear strength of soils depends on the particle size, aggregation, density, structure, moisture content and drainage conditions during shear and also, loading history for cohesive soils. The shear strength of soil mass is the internal resistance of the surface area of soil, which can be used to deal with a failure or slip along any inner surface. Therefore, considering the importance of embankment slopes, the effect of static forces and earthquakes on their stability is of vital importance.