



Evaluation of Earth Dam Leakage Considering the Uncertainty in Soil Hydraulic Parameters

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Abstract

Analysis of earth dams is generally conducted in three stages of stability, deformability and water penetration analysis. Lack of sufficient attention to leakage, as one of the most important issues, leads to erosion and destruction of slope stability. The aim of current paper is to analyze the earth dam leakage with respect to the existing uncertainty in soil hydraulic parameters. In this research, the Monte Carlo (MC) method was used to calculate soil hydraulic parameters. Using these parameters, analysis of Alborz earth dam leakage by means of SEEP/W model based on the finite elements method was investigated. Due to the hydraulic conditions of the core soil, the total head value, pore water pressure, and water flux in core region will change. The results indicate that uncertainty in the hydraulic parameters of Alborz earth dam are significant, thus risk is important in this dam. The application of the proposed methodology in estimation of leakage from Alborz earth dam in Mazandaran province reveals its efficiency and proper accuracy in predicting the amount of leakage flow in earth dams with respect to the possible changes in the hydraulic parameters of the soil. Moreover, it was found that the quantity of seepage increases considerably when the dam is without core, therefore, the core is very necessary to decrease the value of seepage through the earth dam.

Keywords: Leakage; Uncertainty; Soil Hydraulic Parameters; Monte Carlo (MC) Simulation.

1. Introduction

By development of urbanization and human activities, drought has increased. About 13% of the world's population is currently deprived from drinking water. Water shortages will increase at current pace of water demand. The earth dams are one of the most important and crucial structures for the storage of water and are used in water resources management [1]. Earth dams are of natural materials without mortar. Therefore, the dam body is not integrated due to the bending and tensile forces and all forces are tolerated by the weight of the dam body and with the help of shear strength of the earth materials. The high cost of construction and the severity of damages caused by the failure of earth dams and uncertainties in predicting the behavior of geotechnical structures in terms of the nature of the earth materials, highlight the needs for care and measurement of earth dams. Therefore, the analysis, calculation and design of earth dams should be performed precisely. Analyses of earth dams are generally conducted in three orders of stability, deformability and water penetration analysis [2]. Nowadays, most of the dams worldwide are facing the problem of leakage. This phenomenon threatens their storage function and sometimes causes unpredicted disasters. In unstable areas, a small penetration may grow and will eventually cause the erosion and often the overall destruction of the whole structure [3]. In case of the avoidance of some issues such as the sudden drop of water levels of the reservoir due to releasing and watering and also the uncertainty of soil hydraulic parameters, lead to sudden changes of the boundary

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