Prediction of Hydro-mechanical Stability of Dam: Using Calibrated Model from Back Analysis and Monitoring Data

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Abstract

Earth-fill dam safety and stability control during service period is important at the view point of economics and social security. Monitoring is very important to control dam security, to compare real action with predicted planning and to make good experience and opportunity for future planning. In this paper, water pore pressure and settlements in different parts of Sattarkhan dam during service period was studied. So at first, according to instrument data installed in the body of dam, calibration of numerical model done and by doing back analysis real properties of materials of dam defined. Then by using the calibrated model, pore water pressures and settlements of dam studied. Analysis carried out by Flac2D Finite Difference software. The constitutive model used was Mohr-Coulomb at the state of plane strain. Results showed that dam will be safe during service period at the view point of hydro-mechanical behaviour. Finally, stability of dam studied from the view of rapid depletion of the reservoir, which results showed safety conditions.

Keywords: Sattarkhan Dam; Monitoring; Finite Difference; Back Analysis; Rapid Depletion.

1. Introduction

Nowadays, water supply is one of the most important problems in many countries, particularly in Iran which has an arid and semi-arid climatic condition. Consequently the limitation of water resources in Iran has caused the need for implementation of methods for acquiring maximum efficiency from the existing and new water supply projects. To supply the human need for water is considered as one of the most serious problems of mankind, for which a variety of methods are used to provide viable solutions. One of these methods is to build dams, which are locations to store water efficiently; therefore monitoring the behavior of embankment dams in view of the special characteristic of soil which in fact is made of the three basic elements, soil, water & air is very important.

Nowadays, utilizing instrumentations in Dams is more common and help safety and stability control of dams. Also, using back analysis techniques due to results of dam instrumentations are more important in studying of dam behavior. Alireza Farivar et al in 2010, did Back Analysis on Tabarakabad dam in which reached the 16 percent difference error of pore water pressure and 28 percent difference error of settlement between instrument results and numerical modelling. Also Back Analysis results of Maroon dam done by Masoud Pelasi et al in 2010, showed 33 percent difference error of pore water pressure and 6 percent difference error of settlement. Omid Khamesi et al. in 2010 reached 13 percent difference error of pore water pressure between instruments recorded results and calculated results of back analysis techniques. Also Ozkan et al in 2006, recorded 53 percent maximum difference error of pore water pressure in Kurtun Dam [1-4]. Vassilis Gikas et al in 2008 showed that the difference between the vertical displacements predicted by the finite element model and monitoring results at cross section locations adopted in the analysis for the entire lifetime of the Mornos earth dam (Greece) and for the period for which monitoring data, is more

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