



Investigation into the Internal Erosion and Local Settlement of Earth-fill Dam- A Case Study

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Abstract

A considerable sudden settlement was discovered on the Esfarayen Earth-fill Dam surface near to the left abutment when the reservoir level rose to 51 m from the river bed in April 2013. As a result, a comprehensive plan was devised in order to detect the problem to establish an appropriate remedial work. For this purpose, the work was divided into three main parts: (1) analyzing the information gathered from the monitoring and surveillance plan; (2) conducting the geotechnical site investigation plan to determine the extent of the problem which the obtained results classify as an internal erosion; and (3) finding the cause of the internal erosion by considering three aspects: geological condition of the bedrock, material susceptibility and a three dimensional numerical modeling. The cause and approximate time of the internal erosion initiation was detected by applying the past loading history of the dam in the numerical modeling with the combination results founded by the geotechnical site investigation. Based on the results, it was detected that a crushed zone of a fault passing through the reservoir was not completely sealed on the contact surface with the clay core. As a result, an additional hydrostatic water pressure depending on the reservoir level was generated through the fault on the clay core which had no influence on the stress distribution inside the core. Consequently, with the water pressure exceeding the minor principal total stress, a crack was formed and extended with time, turning to a large void space. Because of the high quality of the clay core material and its well-designed downstream filter, the internal erosion progression was concentrated on the core and directed to the upstream. When it reached the upstream filter, the filter entered into the core and the material from the overlying part of the dam repeatedly dropped, resulting in a final settlement in the dam surface.