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Investigation of to the Effect of Bedrock Stiffness on Seismic Behaviour of Roller Compacted Concrete Dam

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Abstract

In this research, the effect of bedrock stiffness on seismic performance of roller compacted concrete (RCC) dam is evaluated using probabilistic analysis. Due to the geometry and behavior of RCC dams, a two-dimensional modeling was selected for system. Ansys software is used for modeling and analysis of dam-reservoir- foundation system. Newmark implicit time integration scheme is developed to solve the time-discretized equations which are an unconditionally stable method. The Watana dam, due to San Fernando earthquake has been selected as a case study. In order to propagate the parametric sensitivity to the seismic performance of the system, Monte Carlo simulation with Latin hypercube sampling (LHS) method is used as a probabilistic method and uncertainty analysis. The sensitivity of responses under seismic loading is reliably examined utilizing different values of ratio of bedrock stiffness to body concrete stiffness as random inputs. Consider to obtained results, it is revealed that the bedrock stiffness how can effect on seismic behavior of concrete gravity dams due to earthquake. Regarding the safety of dams due to compressive stresses, various ways have been assessed to investigate the induced tensile stress in the heel and the results have been investigated. Finally, appropriate range of the ratio of bedrock stiffness to concrete stiffness of dam body is presented to assess the safety design.

Keywords: Uncertainty; RCC Dam; Bedrock Stiffness; Latin Hypercube Sampling; Interaction.

1. Introduction

In last decades, the use of roller compacted concrete (RCC) dam made a revolution in dam industry. Some purposes such as the high speed of construction and also the economical design were led such structures to be regarded by engineers using RCC technology. So, it is necessary to propose a proper method to design and analyze these kinds of dams with respecting to some factors. These factors can be the construction location and design on the basis of appropriate stiffness of foundation or bedrock.

Chuhan and et al. studied the nonlinear failure of roller compacted concrete dams using laboratory tests. In their research, samples of roller compacted concrete used in construction of Longtan dam was tested and the required nonlinear parameters and stress-strain curve in tension were obtained to use in nonlinear analysis. The biggest block of dam with nonlinear failure criterion undertook the nonlinear seismic analysis. Obtained results illustrated cracks near to dam heel and at the parts of inclination in downstream spread to the upstream [1].

Hui Zou and Trevor offered a numerical model for simulation of behavior of roller compacted concrete dams in which the stress-strain relation have been modeled with multi-layer structure to define elastic and elastic-plastic behavior. As

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