Journal of Civil Engineering and Materials Application
Journal home page: http://jcema.com

Received: 02 October 2018 • Accepted: 28 January 2019

Research

doi: 10.22034/jcema.2019.92027

Investigation into the Effect of Bed Stiffness on Seismic Performance of Concrete Gravity Dam Under far- and near- field Earthquakes

Farzad Naseri[1], Ahad Bagherzadeh Khalkhali [2*]

[1] Department of Civil Engineering, Islamic Azad University-Electronic Branch, Tehran, Iran.
[2] Department of Civil Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran.

*Correspondence should be addressed to , Ahad Bagherzadeh Khalkhali, Department of Civil Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran; Tel: +9809121023519 ; Fax: +9888944857; Email: A-bagherzadeh@srbiau.ac.ir .

ABSTRACT

Today hydraulic reservoir structures are one of the most significant structures over the world and, on the other hand, have become of great importance because of current droughts, particularly in the Middle East. Concrete dams are noteworthy superstructures amongst these structures and their construction and maintenance involve intensive research. In this study, the effect of bed stiffness on a concrete gravity dam is examined under far- and near-fault ground motions. This study is conducted through the numerical modeling of Pine Flat concrete dam as a case study via Abaqus software, the import of 6 far- and near-field accelerograms and the investigation into the effect of 3 stiffness ratios. The results indicate that the stiffness ratio of 1 has a more reasonable effect, for which the response of structure is more logical and appropriate.

Keywords: **Concrete gravity dam, stiffness ratio, dam behavior, Pine Flat, far- and near-fault**

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1. INTRODUCTION

Given the obvious water crisis around the world that many countries are faced with, especially in the Middle East, the protection of water resources is so important. Since dams are one of the hugest water resources employed for many purposes, such as power generation and agriculture, the protection of these superstructures is of great importance. In a study on the Xialuodu Dam in China in 1988, where the modeling was conducted by 30% increase in allowable stress under seismic stimulation, 30% increase in dynamic elastic modulus and a damping ratio of 0.05, it was concluded that the flexibility of foundation cause changes in motion frequencies and dam-foundation movement modes. The seismic energy is also dissipated in an infinite medium of foundation, which is 1.5 times the height of the dam [1].In 2007, a dynamic analysis of the dam and reservoir was carried out in regard to the effects of energy absorption on the boundaries of reservoir. They considered water as an incompressible material to accomplish the modeling in relatively actual conditions and properly notice the impact of energy absorption by water during earthquakes. They then concluded that when water is considered incompressible, a large part of energy is absorbed by water and the construction cost is reduced dramatically [2]. In 2009, Iranian researchers performed a case study on Marrow Point Dam to examine the effect of water-structure interaction using the Westergaard added mass model with a viscous damping ratio of 0.05. They also considered the fluid incompressible to model the reservoir. The results of their research suggested that conventional models of concrete dams are less compatible with reality, e.g. Mohr-Coulomb and Drucker-Prager