FAULT RUPTURE PROPAGATION THROUGH ZONED EMBANKMENT DAMS

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Keywords: Fault Rupture, Zoned Embankment, Finite Element Analysis, ABAQUS, Soil Behavior

ABSTRACT

This paper presents the results of numerical modeling of fault rupture propagation of reverse faults through a zoned embankment dam, at the end of construction. Nonlinear Finite Element Method is used to evaluate the effects of fault activity in dam foundation. The results have been verified with centrifuge physical simulations and the dependency of results on mesh density is studied. The effects of soil compaction are considered using tow typical materials for shell of the embankment which are representative of dense and loose soils. The effects of fault position are also studied in this paper. The results are presented in the form of maximum plastic strains localized in embankment and also surface displacement gradients, to evaluate rupture patterns formed in zoned embankment.

INTRODUCTION

The seismic responses of structures due to near faults are the subject of researches in the recent years. Among the structures, the dynamic analysis of embankment dams and their safeties are of great importance. Analyses of dams without considering their surrounding active faults may result in catastrophic events. The destructive effect of fault activity in dam foundations can be evaluated in two ways; the time history analyses of embankment dams due to seismic loadings and the effect of permanent quasi-static offsets on the fault under the dam foundation.Although, dam construction in the vicinity of an active fault should be avoided, however, in some cases, there is no better alternative. According to Sherard et al. (1974), in highly active seismic regions, due to existence of many faults and the fact that river channels often follow the fault direction, dams are mostly built in locations where faults are recognized or are suspected to exist. Furthermore, discovering the active faults in dam sites may not be possible unless a detailed geoseismic survey is performed or the dam foundation is excavated; whereupon the extra costs will be imposed to the project (Bray, 1990). In addition, in some seismic regions such as the High Zagros region in Iran, almost all