

Numerical study on the liquefaction resistance improvement effect by self-weight consolidation of a reservoir dam

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Abstract

Liquefaction of sand and silt layer induced by earthquake is an important cause of embankment failures. The Qingcaosha reservoir dam was built on slightly liquefiable area with self-weight consolidation as the only foundation treatment. To understand, 5 years after the dam was built, whether the liquefaction strength of the foundation was improved by the self-weights consolidation, a fully coupled numerical model for seismic finite element analysis of soil, FLIP, was used to simulate the reaction of the foundation to earthquake-induced liquefaction before and five years after the dam was built. After a comparison was made, the result shows that after 5 years of consolidation by self-weight, the percentage of the higher pore pressure ratio (0.8-1.0) area had decreased from 12.84% to 3.73% according to the analysis of the #4 North embankment profile. A similar decrease can also be found on the profile of East embankment #7 profile. The result also shows that the total settlement of the embankment top of North embankment #4 profile had decreased from 19.5cm before the reservoir was built to 17.30cm after it was completed. As such, it is proved that the liquefaction strength of the sand was indeed improved to some extent.

Keywords: Numerical, Liquefaction, Dam, Embankment, self-weight, densification