Seismic analysis of an asphalt facing rock-fill dam for assessing its structural integrity and the repairing method of its cracks caused by the north Nagano earthquake. -2nd Stage-

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Abstract

The north Nagano earthquake on March 12, 2011 caused cracks in the asphalt faces of Konoyama-dam and its reservoir located Niigata-ken, Japan. In 2001, the asphalt faces of the dam site were renovated aiming at the same level of safety and serviceability as Yashio-dam (another asphalt facing rock-fill dam located in Tochigi-ken, Japan) against earthquakes. However, the asphalt faces were damaged by the earthquake even though the acceleration at the dam site is below considered earthquake level at its design phase. Therefore, the damage mechanism has to be investigated.

Konoyama-dam, its reservoir, their asphalt faces and their surrounding area were modeled in the seismic analysis by FEM. It is demonstrated that the three-dimensional site effect of cliffs located at approximately 2km away from the dam can have significant impact on the earthquake-induced strains in the asphalt faces. At a certain instant of time, the locations of maxima of the maximum principle strains agreed with the cracked location on the asphalt face of the dam. It is suggested by the analysis that it is important to include an appropriate surrounding area in order to capture the site effect for the seismic safety of the asphalt facing dam.

Keywords: Large scale finite element analysis, ashalpt impervious face, dam, reservoir, seismic analysis, three-dimensional dynamic analysis, site effects