ACTIVE FAULTING AT THE GOTVAND DAM SITE BASED ON SEISMIC AND GEOTECHNICAL DATA

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Keywords: Active Faulting, Geotechnical Properties, Seismic Data, Pir-Ahmad Fault, Gotvand Dam

Active faulting and subsequent movements in dam foundations can cause structural distortions. Such movements may manifest as rock failures, crushing and dislocations that affect geotechnical properties of dam sites. Regarding to dam safety issues, faults with surface breaking and potential block movements are the main point of interest (Wieland, 2009) and accordingly should carefully be studied, especially on the field. The Upper Gotvand dam is the highest rock fill dam with clay core in Iran. This dam is the last one of cascading dams which has been constructed over Karun River in the southwest of Khuzestan Province as the largest river of the country. The dam is 182 m high with a crest length of 750 m and has a reservoir volume of 4.5 billion m^3. It was planned to produce 4250 million KWH electrical energy per year. Flood control, water regulation and tourist attraction are some of its supposed targets. Its location in the Zagros active belt as the most active seismotectonic zone of the country had some problematic effects on it including stability of the abutments and seepage potential through the foundation and abutments. The dam is underlain by the conglomeratic Bakhtiari Formation overlying the sandstones of Agha Jari Formation. Besides, due to exposure of a unique salt piercement of evaporitic Gachsaran Formation about three km upstream the dam body, seepage through the left bank of the reservoir can be crucial (Barjasteh, 2012). The right abutment of the dam is composed of a highly fractured and displaced mass whish is the main situation for seepage. This fractured zone is the result of thrust faulting which has ridden the evaporitic Gachsaran Formation of Miocene Age over Bakhtiari Conglomerate of Pleistocene Age and is composed geomechanically of poor rocks. The fault is described as a branch or the continuation of famous Lahbari active fault with nearly 70 km length. Morphotectonic investigations show that the regional tectonic activity is high and there is well defined relation between the fault occurrence and fracturing. Drainage pattern in the study area also show fairly coincidence with joint systems surveyed in the region. Accordingly, to prevent any seepage through the right abutment, a concrete cut-off wall was established. Geotechnical and seismic data revealed potential activity of these faults especially the Pir-Ahmad fault that passes through the right abutment of the dam. The right bank of the dam has a complicated geology and is highly fractured and dislocated having shear zones, clay filled fractures and open fractures. The origin of the dislocated material according to the present work is almost certainly active faulting. The Pir-Ahmad thrust fault on the northern side of the right bank with a nearly W-E to NW-SE trend and a north dipping plane caused such failure. It has ridden the Oligo-Miocene evaporates of Gachsaran Formation over the above younger formations.

Geotechnical section along the dam axis indicates four along strike faults near the right bank (Figure 1). Due to high compressive stresses normal to the anticline axis, the Agha Jari layers are very tight beneath the dam axis with a 30° inter-limb angle indicating a shevron fold. Since the Pir-Ahmad fault was not considered in the stability analysis of the project, it should be considered and evaluated in dam safety plans for future seismic events. Finally, it could be concluded that geologic structures have a key role on stability and seepage problems of dam body and its reservoir.

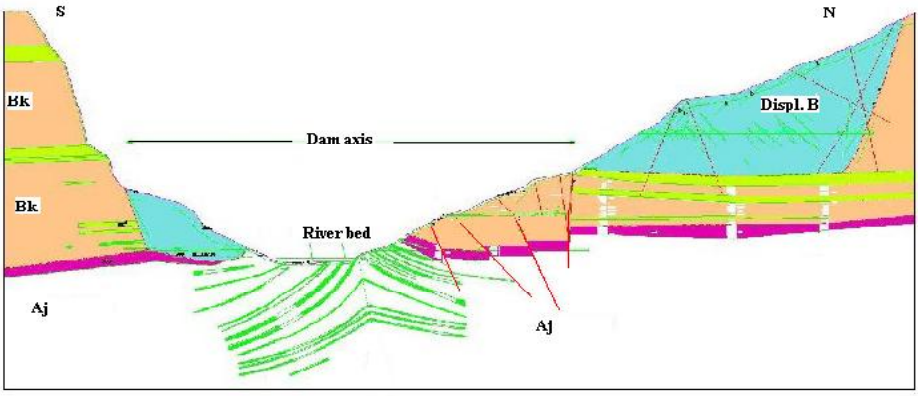

Figure 1. Simplified geotechnical section along the dam axis showing location of small faults (after Ahmadi et al, 2008)

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