STRENGTHENING AND SEALING OF GOMAL ZAM RCC ARCH-GRAVITY DAM FOUNDATION IN PAKISTAN

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1. ABSTRACT

Gomal Zam Dam (Multipurpose Project) is situated at Khajuri Kach on Gomal River in South Waziristan Agency. The dam’s planned provision is to store water of rivers Gomal, Zhob and Wana Toi ensuring continuous water supply both for irrigation and drinking purposes, flood control, and power generation (17.4 MW) in the second phase.

The main dam is an RCC arch-gravity structure of 133 m height, 231 m length, and 10 m top width, located in a narrow valley with very steep abutments. Top elevation of dam is 763 masl. The dam foundation consists exclusively of Jurassic limestone with minor intercalation of thinly bedded calcareous marls, marls and fine-sandy claystone/shale. The strata form a wide spanned anticline generally striking perpendicular to the valley dipping with 30° to 70° gently to steeply towards upstream. Obviously, repeated internal folding has caused distinct to heavy tectonization of the thinly to medium bedded limestone.

The presence of karst is disputed since direct signs of karstification such as open channels or cavities are rare and basically limited to particular faults. However several indirect signs such as increased permeabilities (8 Lu to 90 Lu) or perched groundwater at the riverbed exist. At the dam site the main groundwater table was found 28 m to 30 m below the river level.

Various geological investigations have been performed since the beginning to clarify the phenomena, and to apply appropriate treatment measures.

Main geological problems include major faults in the right abutment striking sub-parallel to the river and thus jeopardizing the dam stability, the high permeability of rock mass causing considerable seepage through the foundation, as well as the loosing of the highly tectonized limestone. The geological conditions and their impact on the stability of the arch-gravity dam are discussed. Treatment of the faults in the right abutment comprise the implementation of concrete shear keys with concrete filled shafts and tunnels at several levels. In order to improve and strengthen the jointed rock foundation, deep-extended consolidation grouting with high pressure was carried out over the entire footprint area. To seal the foundation and to prevent considerable seepage beneath the dam, a clay blanket was placed between the upstream face of the main dam towards the clay core of the upstream rock fill cofferdam. Last but not least a deep grout curtain starting from grouting galleries and adits was implemented. The Gomal Zam RCC arch-gravity dam was completed in 2012. Initial reservoir impounding started in March 2011. The actual seepage conditions, as well as proposals for further treatments of the foundation are highlighted.

Keywords: geological investigation, foundation treatment, reservoir watertightness, seepage, sealing work, grouting, upstream blanket.