

Geotechnical aspects of Attabad landslide dam

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The devastating landslide of 4 January 2010 at Attabad in Hunza valley involved a massive movement of over 50 Mm³ of rock and debris that created a blockade on the Hunza River. The landslide could not be readily linked with any specific triggering mechanism; it can be associated with the Astore Valley Earthquake 2002 that resulted in initiation of cracks near the top scarp. The landslide dam resulted in submerging about 22 km of Karakorum Highway (KKH). The crest of landslide dam with its height ranging from 162 to 200 m above the river bed across the valley resulted in creation of lake by impoundment of about 450-500 Mm³ of water within first few months. The impounded water is posing a permanent threat to the stability of adjoining slopes on upstream of the landslide dam that may generate a wave resulting in overtopping of the dam. Furthermore, the lake is also endangering lives and properties downstream in case of overtopping and/or a dam break. The landslide dam is still surviving even after a period of more than two years against initial predictions of dam-break within first few months. Water level in the lake is being lowered by widening and deepening the spillway in stages to minimize the realignment of KKH. The material involved in the landslide consists of hard rock and fine matrix. The hard rock is mainly granodiorite with size of individual pieces ranging from few centimeters to tens of meter, whereas, fine matrix primarily consists of rock flour with traces of silt and clay. Present study discusses the causes of occurrence of Attabad landslide, geotechnical investigation of material involved in the sliding, and performance of the landslide dam since its occurrence. The study also compares the performance of Attabad landslide dam with similar dams that occurred in the world. Laboratory tests suggest that the fine matrix has low plasticity, a small clay-size fraction (particle size ≤ 0.002 mm), and very low hydraulic conductivity. The low hydraulic conductivity of fine matrix suggests that possibility of failure due to piping may be very little.