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Design-Build Tunnels and Shafts at the San Roque Project

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Abstract:
The San Roque Multipurpose Project, in the Philippines, is one of the largest Build-Operate-Transfer (BOT)/Design-Build hydropower projects that has been constructed. The project cost $1.1 billion and was completed in 2003. The tunnels and shafts comprise a significant portion of this cost. The project includes a 200m high embankment dam, a 12,800 m^3/sec spillway, a 345 MW powerhouse, eighteen tunnels and seven shafts. The tunnels vary in size from the 10.4m x 16m diversion tunnels to the 305m to 4.5m grouting galleries, and the shafts vary in size from the 28m wide by 80m long by 48m deep shaft for the powerhouse and the 23m diameter surge shaft to the 105m diameter grouting gallery vent shafts. The tunnels were all excavated by the drill-and-blast method and the shafts were excavated by the raise bore and slash method. The BOT development put the design and construction on a fast track and the design-build contract offered many opportunities for the designers and constructors to work as a team to develop the most efficient and cost effective methods to complete construction in an accelerated schedule. One of the major changes from the initial concept was the use of shotcrete lining for the diversion tunnels, which saved six months on the construction schedule. This paper describes the design and construction of the tunnels and shafts.

Keywords: uplift and volcanism; ground behavior and rock support; diversion tunnels; tunnel shape; tunnel lining; tunnel invert lining; tunnel support; tunnel construction equipment; power tunnel; grouting galleries.

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