

Hydraulic model tests of the river runoff power plants on Sava river, Slovenia

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Abstract

Ever since 1997 the Institute for Hydraulic Research from Ljubljana practices some hydraulic model tests of the lower Sava river hydropower plants. In fact the initial testings were made in mid eighties, yet only one HPP of six planned ones was really built according to the original schedule and plans. After that, due to the financial gap, a decade without any activities occurred. In the meantime the only HPP that has been put into the operation operated normally and at the same time it served as a “guinea-pig” to the designers. Very soon after the beginning of the normal full-power operation it has become obvious, that there are many circumstances, which haven’t been taken into account during the designing process. Some of the problems appearing during the operation have been solved immediately, but some of them could have never been solved adequately. A very evident case has been explained in a paper “Spillway with Improved Dissipation Efficiency Side Dissipation Beam”, which was presented in Porto 2004. In flood water conditions and by increased discharge the Sava River brings along great amounts of floating material (debris, trees, bushes etc.). This material accumulates on the dam, in front of the gates of the spillways. It jeopardizes the operation of the gates and the evacuation of flood waters. This floating material must be permanently flushing with water flow which can only be achieved by demanding manoeuvres with gates of the plant operators. This means that the discharge must be asymmetrically increased in one of the 5 spillways. Such a mode of unsymmetrical gates operation is unconformable to the operational capacity of the structure; however, it will be impossible to avoid it in the future. The stilling basins of the spillways are designed only for symmetrical gates operation and consequently they do not bear any overloading. Behind the unsymmetrical opened spillway the tailwater level is lower than predicted due to the water level of 2nd conjugate depth and hydraulic jump “escape” out from the stilling basin in the riverbed which is non-resistant to erosion. The consequences of hydrodynamic overloads on the downstream riverbed result in highly increased erosion of the river bottom and river banks downstream of the structure. Till the year 2002, the river bottom (carbon slate) was scoured for over 8 m below the original bottom level. This is only one of the problematic cases, which have appeared on the first HPP in the chain. Many other circumstances also pointed out a need to treat each HPP in a chain, which has been initially designed as a chain of identical objects, as a unique object, considering all up-to-date knowledge, which was improved by each new designed HPP in a chain.

Large efforts to fulfil all the necessary conditions for establishing the optimum operation of all the newly built power plants were made. This included also complete hydraulic model tests for each project in a chain, concerning all possible aspects of placing the HPP structures into the river flow and the influence of the rather unregulated environment on the plants. The present paper represents a wider aspect on the differences between four hydro power plants in a chain of six, which were built or designed until today and it brings out most reasons for the deviations from the original plan of six identically designed hydro power plants.

The Authors

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