Title: THEORETICAL–EXPERIMENTAL STUDY OF AN UNUSUAL SYSTEM FOR THE DISSIPATION OF ENERGY AT THE BOTTOM OF A WATER FALL.

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Abstract.

In designing of open channels for water delivery we often find the problem of having a ground with big differences of level, and, therefore, a channel with high slopes. This means that the water flow in the channel has much level energy and, in open channel flow, this energy must be dissipated. If we do nothing about this, the energy will be dissipated only by means of the friction with channel bottom and wall. For this being possible, the water velocity must be really high and the flow will become aggressive and unstable. The best way of slowing down the water flow is to force the occurrence of an hydraulic jump. This flow phenomenon is accompanied of a considerable energy loss due to internal flow turbulence.

The traditional and most frequent system to force the occurrence of an hydraulic jump is to deepen the channel bottom generating the so called 'deading bowl'. The present study analyses an alternative system to form the hydraulic jump and get the energy dissipation. This other system lies on the contraction of the channel section keeping the original channel bottom level.

The analysis lies on the empirical data obtained by means of a reduced scale model. This model reproduces the complete system and is composed by a water fall (what means high flow acceleration) followed by the contraction which raises the water level in the channel and forces the occurrence of the hydraulic jump between the fall and the contraction. After this the flow at the contraction exit should be more calm and the velocities should be lower and admissible. The model is adjustable, that means that it has movable parts that allow variations in the contraction geometry. Then we can get a large span data to work with.

Once the model essay program was concluded and after the analysis of the experimental results the next conclusions are presented:

- There is a big difference between the results obtained by means of the channel classical theory and the experimental results of a local contraction phenomenon. The complexity of this phenomenon makes impossible to study it with simplified unidimensional procedures. A more complex tridimensional analysis is required.
- We have obtained a compact method for the designing of the dissipation system by means of its characterisation using the adjustment of discharge equations and drawing loss abacus and discharge coefficient abacus. This method fits to any other fall since it admits variations in design parameters such as the fall height, the initial flow energy, the channel width or the design flows.
- The dissipation system is worth using since it achieves energy flow dissipation rates above 66% refereed to the entrance energy. In addition the flow at the contraction exit is quite smooth, with few turbulence or crossed waves. When a flow over the top design flow gets into the system, it ends working rightly since the hydraulic jump disappears. In this conditions there is a lower energy dissipation but the water level does not raise any more what could be much worse if the channel is closed on the top. Beside the traditional system it has the advantage of no needing to deepen the channel bottom. This means an important economic spare in ground excavation en contention.
- Some disadvantages could be, on one hand, the design greater complexity and, on the other hand, the careful construction requirements.