Experimental study of local scour magnitude produce by a sky jump

Author: Jordi Cid Solé.

Abstract

Some hydraulics structures make in rivers need the design of structures that produce a waterfall. Local scour by waterfall has importance because it can produce the undermine of the hydraulic structure and its collapse. Local scour doesn't produce problems in the hydraulic structures only; it can produce problems in the structures and environmental problems downstream.

Existent of rock stratum limits the thick of erosive material and changes hole geometry produce by waterfall. Rock stratum limits depth of the sour hole and changes the flow structure, affecting length and width of the scour hole. The influence of rock stratum in the geometry scour hole has considered to characterize the geometry of scour hole.

In this dissertation we do a bibliographic search about scour hole produce by a waterfall and the influence of rock stratum in the geometry of it. The results of this search are that exist many formulas to estimate the depth of the scour hole when the thick of the erosive material are infinite, nevertheless only exist two formulas to estimate the length and the width of the scour hole. Neither of this two formulas has considered the influence of the rock stratum.

The difficulty to measure the scour hole in the reality get necessary to study local scour in the laboratory using reduce-scale models. Develop new measure techniques make time in tests and improvement the quality of results.

This dissertation developes a new photogrammetry technique to measure the scour hole and its dune, explaining steps to apply it, necessary softwares and error magnitude.

The photogrammetry technique consists of photographing the contact between the water surface of the deposit and the scour hole or dune. The contact is a section between a horizontal plane (water surface) and the scour hole or dune. The contact is a level line. We obtain different level lines of the scour hole and its dune if we photograph the contact when discharge the deposit.

Scour hole depth temporal evolution when we have a infinite stratum of erosive material and equilibrium time are considered in this dissertation.

Finally, this dissertation finds the characteristic variables of the local scour make by a waterfall, thus the relationship between they and the scour pit variables: length, width, form factor and depth. The relationships found are useful to design structures hydraulics and independents of the geometry structure that produce the waterfall. Also, the relationships to obtain the length and the width of the scour hole consider the influence of rock stratum.