

Study of the protection measures against local scour at bridge piers.

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This thesis work in a study on the phenomenon of threshold of movement of the particles of a river bed on which there is a bridge pier. The desired objectives were to understand the phenomenon, determining the main factors as well as their relative importance, and apply the acquired knowledge to construct a dimensionless graph which will serve to provide the dimensions of riprap.

For this, an intensive study was made to characterization the different sediments as well as the set up of the steep canal of the River Morphology Laboratory (GITS-UPC) in DEHMA. Experiments were carried out to generate the necessary conditions of threshold of movement, changing both the makeup of the riprap, and also the diameter of piers. Five different types of grains were used for the riprap, combined with the different diameter of pier. In total, seven different piers were used, four different widths for square piers and for the circular ones.

Ninety conditions of tests were made, and in each one the largest number of data was taken with the objective of realising an exhaustive analysis. Thanks to this, this study is not only centred in the determination of threshold of movement, but also trying to look into the interpretation of the influence of the non hydrostatic pressures.

The formula derived from the study is based on a comparison between stabilising and destabilising forces, on one hand gravitational force, and on the other the force created by vortices generated by hydraulic action and in presence of a pier. The defined factor Φ is the relationship between them.

Once the factor was defined, it was related with the other variables with the relevant importance in the phenomenon. Using this information a dimensionless graph was made, in which Φ varies with the grain size and pier diameter relationship.

After obtaining a formula, proceed to compare between other existing equations formulated for the same problem. The relationship formulated by Isbash, Richardson, Breusers and Bonasoundas were used.

The conclusion drawn is that the proposed formula tended to present results 50% greater than expected. However, when the influence of non hydrostatic pressure was included in the relationship, a better accurance in results were obtained. In this case, the difference between expected results and obtained ones was 15%.