Internal flow features around bridge piers

Bridge hydraulics has received a particular research attention during the past years, because of several bridge failures worldwide associated with the relevance of bridges as a basic infrastructure. Often the bridge collapse is initiated by scour during a flood event.

Presently most research activities focus on the investigation of scour in terms of scour depth and scour extension by both numerical and physical modelling. The present study aims to contribute to the understanding of the governing velocity pattern and its temporal development during the formation of scour, including the indirect determination of shear stresses that determine the numerical prediction of the scour process.

Fig. 1: Bridge pier scour in New Zealand (Melville and Coleman, 2000).

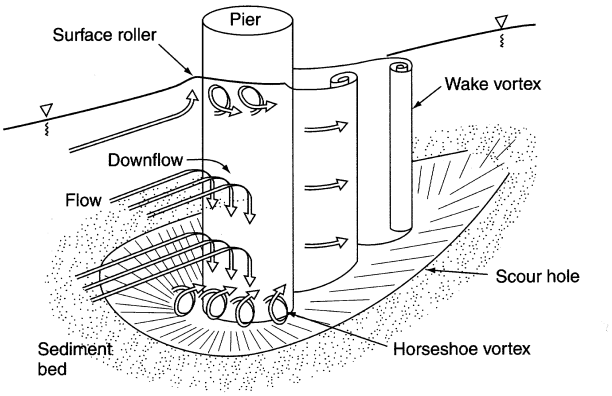

Fig. 2: Main features of flow around a bridge pier (Hamill, 1999).

In the present experimental set-up the highly complex 3D velocity field is partitioned into adjacent 2D layers parallel to the main flow direction with the aid of a light-sheet. These flow fields are observed with a suitable PIV system and then matched to result in a spatial velocity field. Simultaneously the geometric parameters of the scour are observed with a combined automatic measuring device based on a laser-distance sensor for bed readings and an ultrasonic sensor for free surface determination. The variables investigated are discharge, flow depth, grain size distribution and pier geometry.

- HAMILL, L. (1999) Bridge Hydraulics. E & F Spon, London and New York.
- MELVILLE, B. W. & COLEMAN, S. E. (2000) Bridge Scour. Water Resources Publications, Highlands Ranch (CO).

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