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Versuchsanstalt für Wasserbau,
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Hydro-Abrasion at Hydraulic Structures and Steep Bedrock Rivers

Reservoir sedimentation threads the sustainability of many reservoirs worldwide. The need of decrease or complete removal of sediment from reservoirs by using sediment bypass tunnels (SBT), or sediment flushing and sluicing facilities (SFSF), amongst others, will consequently increase considerably in the future to maintain reservoir sustainability as well as sediment connectivity. However, flows with high velocities and high sediment transport rates can cause severe hydro-abrasion at such hydraulic structures as well as riverbed incision (Fig. 1a). Therefore, a better understanding of abrasion mechanics and development of an abrasion model are of fundamental importance for both sustainable design and operation of hydraulic structures and river and landscape evolution. To this end, VAW has conducted a systematic laboratory study on hydro-abrasion in the scope of a PhD project. The main objectives of the study are the investigations of (I) the mean and turbulent flow characteristics in Task A, (II) bed load particle motion in Task B and (III) hydro-abrasion mechanics in Task C and (IV) the development of an abrasion prediction model in Task D.

This M.Sc. project will focus on a part of Task C. In this task, various invert materials will be systematically tested in a laboratory flume (Fig. 1b). Hydraulic conditions i.e. Froude number and water depth and sediment size, hardness and supply rates will be varied. The abrasion damage and pattern on the invert materials will be quantified by using a 3D laser scanning system. The obtained data in this task and Task A and B will be used in Task D to develop a realistic and mechanistic model.

The outputs of the project will contribute to the sustainable design and operation of hydraulic structures exposed to heavy sediment load and modeling of river bed and landscape evolution as well as improved knowledge on bed load transport.

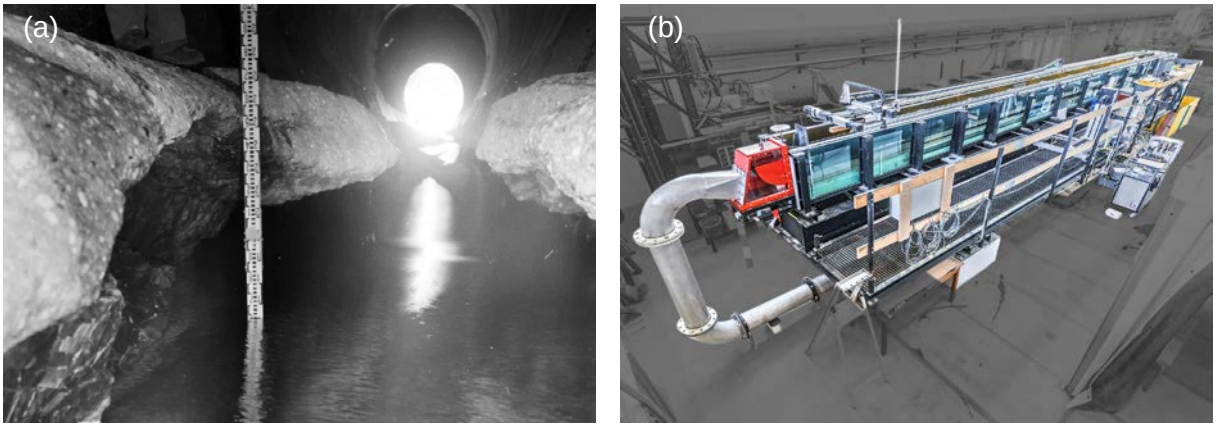

Fig. 1: (a) Invert abrasion on Palagnedra SBT in CH (b) Experimental flume at VAW (Photos: VAW, ETH Zurich)

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