Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Laboratory of Hydraulics,
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Master's Thesis (or Project Work)
FS 2025

Experimental investigation of floating debris at behavioral fish guidance system

Downstream migrating fish in rivers often need to pass over multiple run-of-river hydropower plants (HPPs). Fish passing through turbine or spillway of these HPPs can result in high injury and mortality rates, which lead to a decline in fish populations. In the multi-disciplinary international FishPath project, a turbulent **E**ddies-based behavioral fish **G**uidance **S**ystem (EGS) is being developed for a safe downstream fish passage at HPPs and other water intakes. Vertical, horizontal and streamwise eddies are created using vertical elements, spear, and delta wings elements, respectively. Various geometrical arrangements of these elements with a full depth bypass system have been tested with Salmon smolts, European eels, roach, sprilin, barbel and chub in a laboratory flume at VAW (Fig. 1).
Transported driftwood, i.e. woody debris and organic fine materials such as leaves, may accumulate and block the EGS and its bypass system leading to an increase in backwater and excessive structural loading to the EGS. To mitigate this problem, systematic woody debris and leaf accumulation tests of the various EGSs shall be carried out in in a 1.5 m wide, 1.2 m high and 30 m long laboratory flume in this Master's thesis.

The model debris consists of logs with/without branches in three size classes as well as mixtures of different sizes, and model organic fine materials consisting of leaves of two different tree species. The experimental matrix of test runs includes three discharges and EGS configurations with two selected elements, vertical prismatic and delta wings, with lateral spacing between elements, b = 125 mm, 145mm and 165 mm, respectively. A hand-held flow meter (HFM) and Ultrasonic Distance Sensors (UDS) will be used to measure flow velocities and water depths, respectively. The results of the experiment will contribute to designing a hydraulically efficient EGS-bypass system, which is robust against driftwood and organic fine materials load.

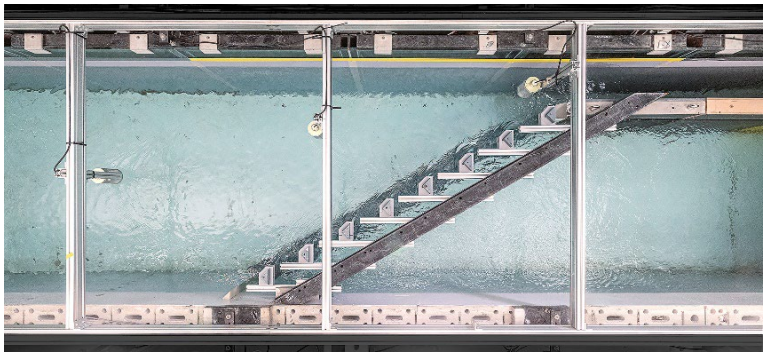

Fig. 1: Top-view photo of vertical prismatic element EGS configuration with a bypass in a VAW laboratory flume

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Remarks: Project-oriented thesis; Thesis communication and report in English.
If chosen as a Project Work the topic must be continued with a follow-up project as part of the Master's thesis (possible for Civil Engineers only).