

## Block ramp in Zell (LU): Investigating failure mechanisms

The block ramp in Zell (Canton of Lucerne, Switzerland) at the Luthern River was destroyed during a flood event in May 2023 (Fig. 1). Since the peak flood discharge was below the dimensioning discharge of the block ramp, the ramp should not have failed. However, it did. The reasons of the failure are not yet known and are currently being investigated by two laboratory studies at VAW. It is assumed that a combination of various unfavorable structural aspects of the block ramp led to the failure, among others are: 1) the built-in fish passage could have destabilized the ramp, 2) the size and the placement of the blocks might have been unfavorable, and 3) the curvature of the river might have led to increased shear stresses on the ramp. However, the extent by how much these aspects destabilize the block ramp are not yet known and must be quantified by experimental studies.



Fig. 1: Remnants of the block ramp after its failure during a flood event in May 2023.

In this study, experiments will be performed in a flume in VAW's laboratory facilities. The objectives of the thesis are to conduct experiments with different ramp parameters to check potential failure mechanisms. The results of this thesis will contribute to a better understanding of the failure mechanism of the block ramp.

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**Remarks:**

Hydraulic laboratory experiments  
Project language: English or German  
1 student for Master's thesis or up to 2 students for project work