

Hybrid modelling: Flood protection Rhone Brigerbad

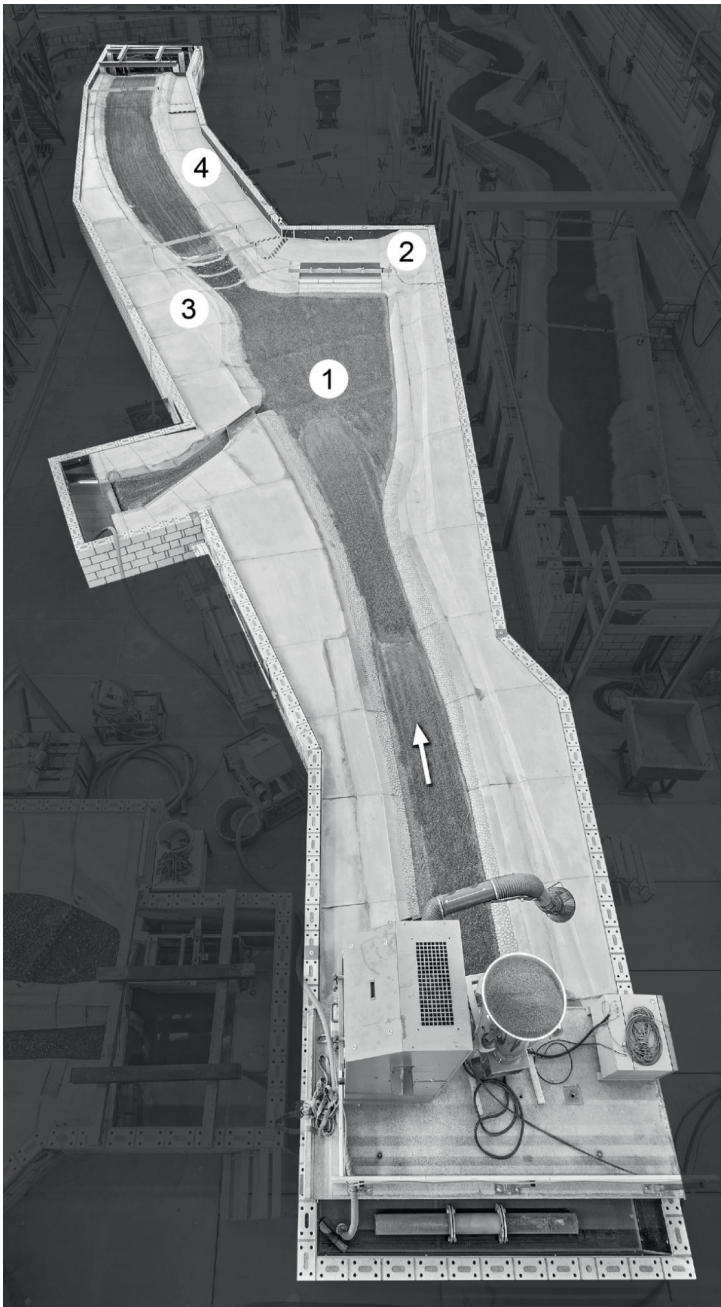


Fig. 1: Hydraulic model "Rhone Brigerbad" at scale 1:50. 1: local river widening at the Gamsa confluence, 2: overflow section, 3: control cross section with block ramp, 4: additional overflow section, river bank with lowered freeboard.

The flood event of October 2000, which led to extensive damages and 16 casualties throughout Switzerland, was a crucial event for the Canton of Valais. The levees of the Rhone River broke at several locations, leading to the inundation of 1027 ha in the surrounding valley. In multiple cases, higher damages were only prevented by local emergency measures.

This event clearly illustrated that the flood protection measures taken in the first (1863 to 1893) and the second (1930 to 1960) correction of the Rhone River are no longer sufficient for the protection of the Rhone Valley. According to the flood hazard map of 2012, 13'000 ha are currently flood-prone in the Cantons of Valais and Vaud, resulting in a damage potential of approx. 10 billion CHF.

In the aftermath of the flood event, the canton launched the third correction of the Rhone River. The planned measures span the entire river course with a total investment sum of approx. 2 billion CHF. Over the next decades, an overall protection against at least a 100-year flood will be reached in the entire valley by combining various measures like dam remediations, river bed lowerings and extensive river widenings. Besides reducing the flood risk in endangered areas, the significant improvement of the ecological situation of the Rhone River is one of the project's main goals. In addition to the general project, which defines the standards and main goals of the third correction of the Rhone River, priority measures have been defined for areas that are most at risk and exhibit a high damage potential.

In the Brigerbad area, general and local river widenings in combination with local flood relief measures shall ensure the protection of sensitive downstream areas up to a PMF-event (approx. 1000-year flood). At the confluence with the Gamsa Torrent, the river bed of the Rhone River will locally be enlarged from approx. 35 m to 120 m. In case of discharges exceeding the design flood of 790 m³/s, an overflow section at the downstream end of the widening ensures the diversion of excess water to

an area with lower damage potential. As a result, peak discharges can be reduced and endangered downstream areas can be protected from levee failures. Downstream of this overflow section, a control cross section with fixed geometry and a fish-friendly block ramp ensures the projected flow diversion ratios. An additional overflow section further downstream with lowered freeboard on the right river bank serves as backup safety measure.



In September 2015, VAW of ETH Zurich was commissioned with the review of the planned measures by means of hydraulic model experiments. The hydraulic model at a scale of 1:50 is equipped with an erodible river bed and covers a river length of 1.5 km in prototype scale (Fig. 1). The following issues are investigated in the course of the model experiments:

- Evaluation and optimization of the overall concept
- Validation of the projected flow diversion ratios for extreme flood events
- Assessment of sediment balances and the corresponding morphodynamic processes for key scenarios
- Optimization of sediment management

In addition to the hydraulic model, the VAW operates various hydronumerical 2D-models of the project perimeter using its in-house software BASEMENT v2.6. These simulations are indispensable for the definition of boundary conditions, sensitivity analyses and the evaluation of planned project modifications.

Keywords: Flood risk, flood protection, erosion, sedimentation, laboratory experiment, physical hydraulic model test

Commissioned by: Canton of Valais

