

FLOOD PROTECTION URI VALLEY

Schmidiger Viktor¹, Schatzmann Markus¹, Bianco Philippe² and Jäggi Martin³

BACKGROUND AND PROBLEM

The Uri valley – a regional economic centre on the north-south Gotthard transit route – has since time immemorial been affected by flooding of the three rivers Schächen, Reuss and Stille Reuss.

Whereas the Reuss, being the main drainage river of the Gotthard mountain range, flows along the length of the Uri valley, the Schächen, being a tributary to the Reuss, is a large mountain torrent which for its final kilometres flows over a large alluvial cone deposited over the last 10'000 years. The Stille Reuss is, by comparison, a smaller drainage channel which has been trained repeatedly in recent times. It passes beneath the Schächen near its mouth and flows into the Reuss a short distance beyond this river underpass.

The 1987 Reuss flood event resulted in large scale flooding of the Uri valley, causing damage in the order of 100 million Euros. Subsequently implemented flood protection measures such as protective levees, the use of the highway as a flood relief channel etc. (see previous Inter-prävent publications) protect against floods with a return period in excess of 100 years.

Since the flood event of 1910 – one of 10 large flood events in the last 300 years – the Schächen flows across its alluvial cone in a paved uniform trapezoidal channel. Following the flood event of 1977, causing some 30 million Euros damage, an "open barrier" sediment retention basin with a storage volume of 100'000 to 150'000 m³ was provided 2 km upstream of the paved channel reach.

During the Schächen flood event of 2005, upwards progressing sediment deposition – with a 3 m high sediment front – occurred in the paved channel section despite partial deposition in the sediment retention basin. A return period of 30 to 100 years and sediment load of 350'000 m³ were estimated for this event. This sediment deposition initiated at the mouth area and the low banks caused the mountain torrent to break out of its paved channel thereby flooding the neighbouring industrial areas. The river underpass of the Stille Reuss was also completely filled with sediment thereby blocking flow in the Stille Reuss. The resulting backwater caused the upstream industrial area to be flooded to a depth of up to three metres. Direct damage was in the order of 200 million Euros, with an overall economic damage of 330 million Euros.

PROJECT AND AIMS

To prevent the emigration of industries – some of which already affected by previous flood events – the canton Uri commissioned an overall flood protection concept study for the entire Uri valley. In this concept, particular attention is placed on the protection of sensitive areas, such as the industrial zone severely affected by the 2005 event. Protection for these areas is to be provided against flood events with return periods of 300 years and more.

¹ Basler & Hofmann Consulting Engineers, Zurich/Esslingen, Switzerland

² Idéalp, Consulting Engineers for alpine environment and development, Sion, Switzerland

³ Consulting River Engineer, Ebmatingen, Switzerland

PROJECT CHARACTERISTICS

For the three water courses, measures were defined as a result of an intensive and iterative process amongst the cantonal authorities, the general population and the project engineers, in which the protection requirements and the economic feasibility of solutions were considered:

Schächen: Optimisation of the existing sediment retention basin, raising of the levee along paved channel, the creation of two additional large sediment retention basins above and in the region of the paved channel reach, bed stabilisation in the reach between the upper and middle retention basins.

Reuss: Upgrading and partial raising of the existing levees, limitation of the flooding zone upstream of the Schächen mouth up to the planned rail embankment of the New Rail Link through the Alps (NRLA), widening of the Reuss at the Schächen mouth over a length of 1 km, addition of a further element to the lateral flood relief weir along the A2 highway, etc.

Stille Reuss: Widening of the river underpass under the Schächen, provision of emergency flood relief tunnel (bypass) to prevent discharge blockages, and downstream relocation of the mouth to the Reuss to reduce backwater effects.

The implementation of the project with a total estimated cost of 35 to 40 million Euros is to be coordinated with the construction work for the NRLA (Gotthard Base Tunnel) in the time frame between 2008 and 2015.

Measures to be implemented in 2020 and later were also described. These include for the Schächen – in accordance to the national concept "more space for rivers" – the widening of the torrent reach over the entire alluvial cone. This requires the implementation of appropriate long-term urban planning measures.

NUMERICAL AND PHYSICAL MODEL INVESTIGATIONS:

Numerical sediment transport model simulations were conducted in order to assess the sediment transport processes of the Schächen with its planned chain of three retention basins, as well as to check the impact of the NRLA railway bridge crossing in this area. It could, for example, be shown that the deposition process can be minimised by the raising of the levees.

To assess the efficacy of the lower sediment retention basin – positioned laterally to the river reach – and its associated complex sediment transport and deposition phenomena, as well as to evaluate the benefits of long-term river widening, a physical model investigation is currently being performed at the Laboratory of Hydraulics, Hydrology and Glaciology of the Swiss Federal Institute of Technology (ETH). To assist with the design and evaluation of the flood protection measures for the complex discharge systems of the Uri valley (Reuss, Stille Reuss, Highway A2, etc.), combined 1D/2D "Mike Flood" discharge and flood simulations were performed.

IMPORTANT FINDINGS:

The Schächen reach between the existing retention basin and the paved channel reach proved to be the source of exceptional quantities of sediment. Bed and embankment stabilisation measures are therefore planned here as well as a sediment retention basin at the low end of this specific reach. Raised levees of the paved channel significantly reduce the flood threat in this critical reach. Hence levee raising is now being implemented here as part of advanced measures. In the long-term, the impact of sediment deposition along the lower reaches of the Schächen can be greatly reduced if more space can be given to this mountain torrent.