NUMERICAL HYDROLOGICAL AND HYDRAULIC SIMULATION OF THE EFFECTS OF A POSSIBLE FLOOD WAVE AS PART OF RISK ANALYSIS AND RISK MANAGEMENT AT THE SUGGADINBACH

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INTRODUCTION

The Maesstobel bears high risks due to a rockslide in the upper reach. There is the danger of debris jam in the receiving stream Suggadinbach caused by tumbling rock and debris flows of approximately 800,000 cubic metres. According to experts, dam failure and a consecutive flood wave would follow. The flood wave would then directly hit the town of St. Gallenkirch.

Due to this scenario, a project was designed which assesses the hazard potential and the effects of this flood wave on the residential area of St. Gallenkirch. The fundamental question is if the discharge peak, together with dam failure, means a higher hazard potential for the residential area at the deposition fan, or if the discharge peak gets flatter through the 2.2 kilometres of canyon reach – which would mean a slimmer hazard potential.

METHODOLOGY

Corresponding to the latest technical standard, laser scan data was used in the project to set up a digital terrain model. Another basis was a detailed geological scan. The hydrologic calculations were carried out with the aid of the HEC-HMS model. As to how much dam failure would flood residential areas, various scenarios were assumed in hydraulic calculations and analyses. So as to increase accuracy and test plausibility, the simulation section was split into three sub sectors according to topographic and hydraulic aspects. In sector 1, debris flow in the Maesstobel is simulated (FLO-2D), involving its flow into the receiving river and the possible maximum height of retained debris and water. Sector 2 deals with the scenario of dam failure (HEC-RAS), and it contains different variants of dam failure and the consecutive flood wave.

RESULTS

The failure takes place at the discharge peak of 180 m³ per second. The breach reaches its peak after roughly 10 minutes and increases the discharge of the Suggadinbach from 180 to 380 m³ per second. This is pure water discharge. The peak is reached approximately 25 minutes after the beginning of the failure. For further calculation of the flood wave, a corresponding debris ratio was added to water hydrograph dam failure, as the deposited bedload of the Maesstobel is subse-

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quently eroded by water and then carried on to lower reach or deposited at the fan. The discharge scenario assumed is a debris flow with 350.000 m^3 of sediment. A discharge peak of 380 m^3 per second plus bedload makes a peak of approximately 760 m^3 per second. In the third sector, there is debris cone and the residential area of St. Gallenkirch. In this section, the worst case scenario is simulated (FLO-2D). The threatened areas on the debris cone are defined.

CONCLUSIONS

On the basis of these findings and results, a bundle of active and passive measures could be worked out as part of a risk management concept. Moreover a new technical construction project, which contains 3 debris-sorting dams, was carried out. In addition to the active measurement passive mitigation measures such as a monitoring system have been installed. This monitoring system is technically improved in order to provide information to local authorities if a debris flow will occur.

Keywords: hydrologic simulation, hydraulic simulation, dam failure