

GLYSSIBACH BRIENZ, SWITZERLAND: FLOOD AND DEBRIS FLOW EVENT ON AUGUST 22/23, 2005

PROTECTION MEASURES AGAINST FUTURE FLOODS AND DEBRIS FLOWS

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The flood and debris flow event in the Glyssibach torrent on August 22/23, 2005 was causing extraordinary high damages and loss of life. The concept of the protection measures as well as preliminary results of a hydraulic model study on debris flow is presented.

PROCESS OCCURRENCE AND ANALYSIS

By reason of topographical, geological and climatic situation the town of Brienz is exposed to a number of natural hazards such as floods, debris flows, avalanches and mass movements. The highest hazard potential thus is caused by mountain torrents. Once in a century high incidents occur, but the event of August 22/23 2005 can be indicated as one of the most severe concerning the combination of flood, mass movement and debris flow. This caused not only the devastation of 13 houses totally and 25 houses partly, but also the tragic loss of lives.

RISK ASSESSMENT AND EVALUATION

It was assessed that for example the Glyssibach – one of the torrents in Brienz – could mobilise about 70'000 m³ of debris flow into the town in a future 100-year event. However also 30-year events mobilising 25'000 m³ of material cannot be handled in the town without new safety measures.

RISK MANAGEMENT AND PREPARATION FOR EVENTS

The first interactions concerning safety of human beings and rehabilitation of the most urgent goods were immediately initiated and a number of preparedness and prevention measures were implemented during the first two weeks after the catastrophe. At the end of September – 5 weeks after the event – the inhabitants were introduced to the propositions of the planning group such as emergency measures, an advanced modular alert concept for evacuations and immediate measures as well as a new concept for the protection of life and value.

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PROTECTION CONCEPTS

Two main considerations were then approved by the citizens of Brienz: The partially demotion of the destroyed building zone for a runoff corridor for 20- to 50-year events and the concept for the diversion of 50- and more year debris flows into a agriculturally used area.

NATURAL HAZARD MANAGEMENT, LEGAL FRAMEWORK CONDITIONS AND SUSTAINABLE LAND USE

There is an ongoing discussion about legal frameworks for land use management in context with natural hazard management in Switzerland for more than 25 years. However the protection concept in Brienz was the first time where these theoretical discussions had to be approved for the proposed reorganization of land in building zones within a few weeks.

STRUCTURAL MEASURES AND HYDRAULIC MODEL TESTS

The diversion of 50-year and more infrequent debris flows into an agricultural area thus not allowing smaller debris flows as well as all sediment-bearing floods into this area – these have to pass the diversion structure and follow the old torrent bed through the planned new riverbed in the town – was a great challenge for the project designers.

A hydraulic model test study is under progress at the hydraulic laboratory of the University of Applied Sciences Rapperswil, Switzerland in order to prove the functioning of the debris flow diversion works. Due to the fact that such a diversion structure with the above mentioned functionality is a unique prototype, research engineers together with the project designer developed the diversion structure, which was tested in the hydraulic model. The composition for the model debris flow material was developed in such a way that the main parameters of the debris flow, e.g. velocity and flow depth have the same order of magnitude in the model and in nature. The diversion structure was also tested for debris flow with different characteristics. With the hydraulic model tests the functioning of the protection concept could be proved. Detailed analysis of the measurements and results are under progress.

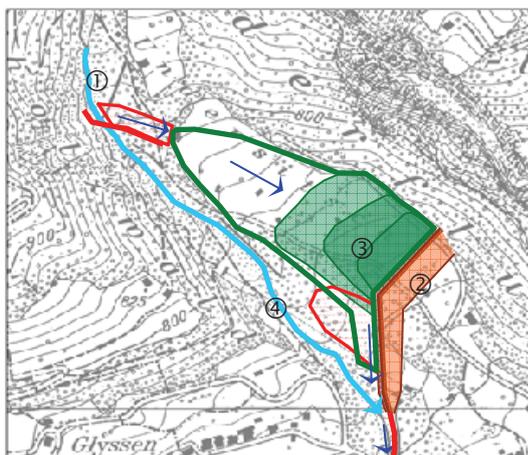


Fig. 1: Concept of the debris flow diversion works:
①: Diversion structure, ②: protection dam,
③: sedimentation area, ④: Glyssibach torrent.

Keywords: Debris Flow, Diversion Structure, Structural Measures



Fig. 2: Diversion structure after passing a 100-year debris flow. Most of the debris flow was diverted to the sedimentation area. Model scale 1:50.

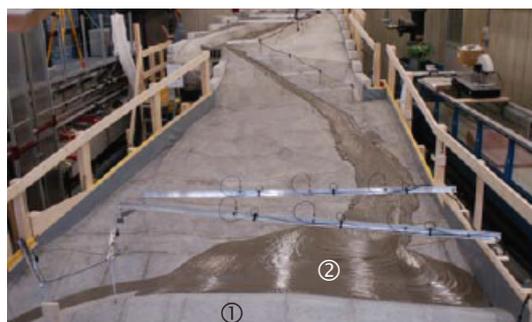


Fig. 3: Protection dam ① and sedimentation area ② after the occurrence of a 100-year debris flow.