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Potential Risk of natural Hazards on Barrier Structures

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Torrential barriers serve for the protection of our human settlement areas against debris flows, avalanches and torrential events. At the assessment of torrential barriers a correct estimation of the values of the loads is very important. Due to the morphological and geological inhomogeneity of the catchment area and mostly lacking measuring data the effective value of these loads are difficult to determine. Therefore in practice barriers are assessed using simplified load models. Mostly the significant assessing loads result from a debris flow event. Therefore simplified formulations to estimate the values of debris flow pressures will be discussed in this contribution

On the other hand another task of the contribution will be the evaluation of probabilistic models for the assessment of torrential barriers basing on detailed stress and resistance sub models. Using this model it is possible to consider the uncertain quantities of the loads when calculating the failure probability of an existing barrier structure. Using sensitivity analysis the ratio of each model parameter to the stability of the structure can be calculated.

Since in practice barriers are designed with simplified deterministic load model they have to be compared with probabilistic models to find out the intrinsic safety level. E.g. simple models are based on the triangular load distribution of the hydrostatic water pressure acting to the barriers backside. Debris flow events are calculated in increasing the hydrostatic water pressure by a load increase factor. Debris flow crash has an uniformly load distribution. Normally the difference between the lever arm of the resulting force of the triangular distribution and the uniformly distributed load is not considered. Such approximations will be compared with the detailed stochastic

model. The ratio of the used simplifications to the stability of the structure will be calculated using sensitivity analysis.

Up to this passage the contribution focuses on single structures. The next task is to show the potential of probabilistic modelling for considering a whole catchment area including a torrential barrier network. Basing on stochastic models for each single structure, it is possible to formulate an integrated model for the barrier network in the whole region. Thereby it is possible to find the critical constituents of the network.

During the last 10 to 15 years reliability based and risk based approaches have been developed for the planning of inspections. These approaches take basis in the decision theory to minimize overall service life costs including direct and implied costs of failures, repairs and inspections. Application is however restricted due to the significant numerical effort required by these methods. The aim within this contribution is too to demonstrate how risk based inspection planning in combination with Bays'sche Updating can serve for barrier structures. The problem of inspection planning for a system of correlated elements, like barrier structures of a region, will be addressed within the generic framework in order to facilitate application on large engineering systems. In view of risk based regulations also the consistent treatment of acceptance criteria regarding the deteriorating processes will be demonstrated. The development of such methods has to be based on decision theory using of structural reliability and modelling of consequences.