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"State of the Art" of technical protection measures in Austria and the effectiveness documented during bedload and debris flow events

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Since the beginning of systematic torrent control in Austria 130 years ago, barriers are constructed for protection purposes. Until the end of the 1960s, solid barriers were built at the exits of depositional areas to prevent dangerous debris flows from reaching high consequence areas. The development of solid barriers with large slots or slits to regulate sediment transport began with the use of reinforced concrete during the 1970s (Rudolf-Miklau, Suda 2011). In order to dissipate the energy of debris flows debris flow breakers have been designed since the 1980s. By slowing and depositing the surge front of the debris flow, downstream reaches of the stream channel and settlement areas should be exposed to considerably lower dynamic impact. In the past, the technological development of these constructions was only steered by the experiences of the engineering practice while an institutionalized process of standardization comparable to other engineering branches was not existent. In future all structures have to be designed and dimensioned according to the EUROCODE standards. This was the reason to establish an interdisciplinary working group (ON-K 256) at the Austrian Standards Institute (ASI), which has managed to developed comprehensive new technical standards for torrent control engineering, including load models, design, dimensioning and life cycle assessment of torrent control works (technical standard ONR 24800 - series).
Extreme torrential events comprise four definable displacement processes floods; fluvial solid transport; hyper-concentrated solid transport (debris floods) and debris flow (stony debris flow or mud-earth flow). As a rule, the design of the torrential barriers has to follow its function (Kettl, 1984). Modern protection concepts in torrent control are scenario-oriented and try to optimize different functions in a chain of protections structures (function chain). More or less the first step for the designing the optimal construction type is the definition of the displacement processes for each torrent section. The criteria for each process are defined in the technical standard ONR 24800 – series in Austria. According to ONR 24800 the functions of torrential barriers can be divided in process control functional types (retention; dosing and filtering; energy dissipation). The last step is the designing of the construction type. Bedload and debris events in Austria showed the functionality of the barriers. On the basis of these findings and results, some recommendations were derived to improve the function fulfilment of the technical protection measures.