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Design criteria for rock fall attenuating systems

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Rock fall attenuator systems don't completely halt falling rocks but intercept rock fall trajectory and guide it under a tail drape. In this way, the kinetic energy is only partially dissipated through barrier impacts deforming the netting and interaction with the slope during its transport to the base of slope. There, the rock can be caught in a controlled manner with only small ditches or low energy fences. This enables a convenient and low priced maintenance and clean out. Ideally the attenuator system is maintenance free.

Until now the loading mechanisms and energy dissipation characteristics have been largely unknown. The importance of net and rock slope interaction during the attenuating process has necessitated a test load that better models the natural occurrence of rock fall. After having completed a large testing series we can present design criteria, and details of the system behaviour, in addition to the benefits and performance of field installations.

The loads within the barriers are much smaller compared to traditional rockfall fences. However, a large net area is necessary to guide the boulder. Loading has been observed to be influenced by both angle of impact and the shape of rock. The system strength and its attenuation capacity is dependant on terrain gradient, impact energy at boulder entrance and the relative friction between rock block and netting. Important for their design is to consider how these systems work in conjunction with the terrain in which they are installed. In order to achieve low maintenance performance of the attenuator system a correct consideration of the self-cleaning properties is important. Decisive in this is slope topography, mesh properties such as size and weight, along with anchoring. The guided rockfall allows the use of only small retention systems at the lower end of the slope due to control of bounce heights and energy dissipation. Details like the length of the drape or the existence of a small ditch define the necessary energy retention capacity.

Application of rock fall attenuator systems are suited to regions of high frequency rock fall whereby cleaning can be better managed. Or for situations where existing protection measures, such as rock galleries, do not meet the required energy level of rock fall hazard, attenuator systems can be applied to reduce rock fall energy to the design value of the existing instillations. Moreover, the protection of long slopes can be achieved using attenuator systems installed a row. An optimization regarding installed material and performance of or interaction between the single barriers will allow for an efficient protection system. Important tasks for the future are to examine the influence of variations in tail drape length along with the performance of attenuator systems installed in a row.