Debris flow interaction with structures: challenges to traditional load models

Alessandro Leonardi, Andrea Pasqua, and Marina Pirulli
Politecnico di Torino, Department of Structural, Geotechnical, and Building Engineering, Torino, Italy
(alessandro.leonardi@polito.it)

Debris flow barriers often feature one or more filter elements, i.e. narrow outlets that induce deposition of the coarsest sediments, while allowing water and fines to filter through. Slit dams and steel nets are examples of this type of barriers. The design of the filter elements must balance the need to trap boulders and to dissipate the flow energy, while keeping maintenance work as low as possible.

Filter barriers elude the traditional load model prescribed by guidelines. Under some conditions, the outlets can clog with large boulders. The time necessary for this to happen mainly depends on the relative size between boulder and outlet, and is a nonlinear function of the flow composition. In any case, the main clogging mechanism is the formation of granular arches. These can induce significant load also in directions different from the main direction of the incoming flow.

Unless the barrier is specifically designed to withstand this type of load, granular arches, but also prolonged flow through the outlet, can induce deterioration and loss of functionality of the structure. In this work, we estimate these effects employing a combination of discrete- and continuum-based numerical methods. We evaluate the performance of two types of debris-resisting barriers, comparing the results with laboratory measurements and with the outcome of a monitoring campaign on a real barrier located in the Italian alps.

References:

How to cite: Leonardi, A., Pasqua, A., and Pirulli, M.: Debris flow interaction with structures: