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Debris flows: protection works and strategy

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ABSTRACT

The defence works against the debris flows can be classified in two categories: the active countermeasures and the passive countermeasures.

The former consist basically in interventions aiming at reducing the risk of debris-flow triggering. Then they are meant to give stability to the debris deposits in the torrents beds or in the hillslopes. The latter instead are works built to defend directly the settlements or the zones subject to debris-flow risk or the single structures.

The works aimed to stabilize the riverbed are the sills or traditional closed check dams, designed to reduce and to stabilize the riverbed slope and therefore to reduce the flow velocity. A system, which augments the channel bed stability, is represented by the chains of consolidation dams. The check dams built for this purpose are absolutely similar to the check dams used in case of ordinary bed-load transport.

More often, open check dams are built to intercept the solid material. Various devises have been proposed for this purpose. The most common structures are slit check dams with a quite large opening often protected by one or more stout buttresses, which are dimensioned so that they can resist to the dynamic impact. The most effective results are obtained by water separation, because the reduction of water concentration increases considerably the energy dissipation inside the flow and consequently its velocity. The hydrodynamic working of such structures is not clear and practical criteria suggested by experience are used for their design. We will show how it is possible to design the hydraulic functioning of these structures with a rational and physically based approach.

These structures must resist above all to strong dynamic impacts. We will discuss the criteria adopted to calculate the dynamic impact of a debris flow surge against these structures.

Finally, we will consider the possibility to use light structures capable to protect settlements from debris flows as efficiently as traditional structures, but at lower costs and with lower environmental impacts.