

EGU2020-4738

<https://doi.org/10.5194/egusphere-egu2020-4738>

EGU General Assembly 2020

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## Alternative approach for works controlling stony debris flows

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Many sites of the Dolomites are threatened by channelized debris flows: solid-liquid surges initiated by the entrainment of large quantities of sediments into the abundant runoff at the head of channel incised on fans, can dramatically increase their volume along the downstream routing. This is the case of the Rovina di Cancia site where solid-liquid surges forming in the upper part of the basin can increase their volume up and over 50000 m<sup>3</sup>, seriously impacting the downstream village of Borca di Cadore. The debris-flow channel ends just upstream the village that in the past was hit by four debris flows (three in the recent years) that caused victims and destructions. Control works built until now are not sufficient to protect the village from high magnitude debris flows and a definitive solution calls to be planned. Present works are a flat deposition area, 300 m downstream the initiation area, an open dam under construction downstream it, and two retention basins at the end of the channel. Between the open dam and the upstream retention basin, there are the rest of eight check-dams made of gabions, built in the 60s and progressively damaged or destroyed by the debris flows occurred after their construction. This series of check-dams limited the entrainment of solid material and the occurrence of localized scours. The initial plan is the substitution of the check-dams with concrete structures and the widening of the downstream retention basin through the raising of high elevation embankment downstream it and the following demolition of the actual dyke. Finally, a channel crossing the village and national route on the valley bottom will deliver the fluid phase from the widened basin to the Boite river. All these control works have a very high cost for construction and maintenance and severely impact the village with the presence of a non-negligible residual risk. These drawbacks call for an alternative solution that is searched looking at to the morphology. Downstream of the open dam and on its right side, there is a deep impluvium that ends on a large grass sloping area. The novel solution requires the construction of a channel through the right high bank that deviates the debris flow into the impluvium. The impluvium, widened through the excavation of the surrounding slopes, is closed at the outlet by an open dam. Downstream the open dam, a channel will lead to a retention basin, where most of storage volume is obtained from the excavation of the grass sloping area, limiting the elevation of the dykes. At the end of this basin an open dam will deliver the debris-flow fluid part to a channel passing under the national route and joining the Boite river. Such a solution composed of a deviatory channel, two retention basins (the deep impluvium and that excavated on the sloping grass area) and the channels between and downstream them, has quite a lower costs of construction and maintenance, eliminating the impact on the village because occupying uninhabited areas without interrupting the main roads.

**How to cite:** Gregoretti, C., Barbini, M., Bernard, M., and Boreggio, M.: Alternative approach for works controlling stony debris flows, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-4738, <https://doi.org/10.5194/egusphere-egu2020-4738>, 2020