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Full scale field testing of temporary rockfall protection measures

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Temporary rockfall protection measures are often implemented by using so-called steel palisades. Such elements can described as a steel surface that is supported perpendicular to the slope surface. In the present case, several sheet piling sections are welded onto a steel frame to form an area 1.5m high and 3m long. At the lateral edges of the surface, steel sections, welded together to form a triangle, create the support of the front surface, so that one side of the triangle is parallel to the impact surface and another side is parallel to the slope surface. At the corners close to the ground, massive steel spikes allow penetration into the ground. The weight of a palisade is about 900kg. An example of such a palisade can be found in [1].

The above barriers are in usage since many years. However, their rockfall energy retention capacity has never been evaluated yet. For that reasons, the Swiss Federal Railways launched a project for a deeper understanding of the performance of the palisades; for an adequate selection of the protection measures and a reliable risk analyses with respect to the variety of rockfall events that can be expected at a specific construction site and might cause failure of a structure.

Failure limits of the palisades are expected regarding the following failure scenarios:

- tilting of the barrier over the valley side steel spikes
- displacement of the barrier due to insufficient action of the steel spikes
- failure of the front surface

In this contribution, the above mechanisms are evaluated by means of 1:1 field tests. A detailed analysis of performance and failure states will be provided. Furthermore, potential solutions for simple but effective reinforcement of the barriers are discussed.

The field tests were carried out on a slope inclined at an angle of about 30 degrees. Test blocks with a minimum weight of 240kg are thrown onto the palisades with the help of a forestry cableway reaching impact speeds of up to 25m/s. The impact energies vary from 12 to 100 kJ. Impact location and impact speed are determined by means of laterally taken high-speed video records with a frame rate of up to 1000fps and a resolution of 800x600pxs. Furthermore, the accelerations in the test body were measured at 1000Hz and – for some of the tests - the acting anchorage forces at 5000Hz.

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