EXPERIMENTAL STUDY OF THE DISSIPATIVE EFFICIENCY OF A MULTILAYERED PROTECTIVE STRUCTURE AGAINST ROCKFALL IMPACT

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Rockfall barriers are required to stop rocks which are rolling down a slope. The common passive protection structures against rockfall are net fences which are mainly used for rockfall energy levels ranging up to 3000 kJ. In view of proposing an alternative technology without metallic components, small soil or concrete barriers designed to stop rockfall for low ranges of energy must be “reviewed”. The increasing land pressure in urban areas becomes so high, that there is a real need to built compact and efficient protective structures. The objective of this work is to develop a simple, long lasting and low cost structure with a maximum impact dissipative action when stopping the rockfall. Instead of simply developing a highly reinforced protective concrete wall, a multilayered structure is considered. The dissipative process takes place in two steps: the first layer made of a regular concrete slab is impacted. In this case, the destruction of this slab is accepted because a part of the impact energy is dissipated within the plastic deformation of the reinforcement steel bar [1]. Simultaneously, the slab spreads the load on another layer which is made of granular material conditioned in a specific manner. It is the deformation of this granular material which will dissipate the major part of the impact energy.

Real scale experimental impact tests are studied. A concrete spherical block is dropped on the horizontal dissipative protective structure. In this configuration, a gravel like material has been used as the dissipative layer. The choice of this material resulted from the small scale experiments. Finally, the coupling effect of the concrete slab with the gravel layer is investigated.

To verify the validity of the measurement device, a reference case made of a single layer of gravel is studied. The impact loading which depends on various parameters, such as the height of the rock drop is well known [2]. Comparisons can thus be set up. Then, multi-layer devices, coupling a concrete slab with a gravel layer are tested. The study focuses on how to contain the gravel material, which has been noted to be crucial for the efficiency of energy dissipation.

The best results in terms of efficiency are obtained when using a concrete slab which is allowed to break and which spreads the loading force on piles of tires which contain geotextile socks filled with gravel. This multilayer configuration is an interesting solution to dissipate the impact energy of the falling or rolling block.

References:

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