

Rockfall hazards analysis

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Rockfalls can be defined as rock falls freely or bounces down a steep slope or cliff. Rockfalls are a major hazard in rock cuts along highways, railways and residential areas in mountainous terrain.

The factors that caused rockfalls are generally internal, external and mechanical. The internal and external factors combined with the action of gravity usually resulted instability of rock mass.

The internal factor is related to geological structure of rock mass. The geological structure of rock mass is controlled by its discontinuities behaviour. Discontinuities are breaks, fractures or planes of weakness in the rock mass and include joint, fault, bedding plane, foliation and cleavage fracture. Discontinuities with adverse orientation will cause rockfalls. The external factors are weathering and erosion process, influence of water and plant growth within the rock's discontinuities. Weathering breaks down rock into pieces and erosion is the physical removal of rock particles by an agent such as flowing water. Severe weathering and erosion will tend to decrease the strength of rock mass and caused rockfall. Water is the main agent to reduce the shear strength of discontinuities surfaces within rock mass and caused instability for the rock slope.

In construction stage, the standard practice was to use aggressive blasting and ripping techniques to construct rock slopes. This mechanical factor will probably be one or two orders of magnitude higher to initiate rockfall than the internal and external factors.

Rockfalls trajectory will indicate the path taken for rock to fall. The most important factors controlling rockfall trajectory are the characteristics of rock slopes (slope geometry, slope height, slope angle and slope surface material). Other factors such as the size and shape of the rock boulders, rock friction angle and whether or not the rock breaks into smaller pieces on impact also have minor impact of controlling rockfall trajectory.

It is not possible to detect and prevent all the rockfall problems because some of the rock slope is not accessible due to very steep, high and dangerous condition for the slope inspection. The rockfalls protection method such as wire netting, catch fence and sprayed concrete should be implemented for protection against rockfalls. The factors that caused rockfall and control rockfall trajectory should be known prior to select the best method for rockfall protection.
