

Method for mechanical loosening the solid rock using undercut anchor

Under special conditions, the KOMAG's patented technology of destruction of the rocks cohesion using bolts anchored in the solid rock is an alternative method to traditional mining methods, e.g. mechanical or blasting (Fig. 1). This technology does not damage rocks outside the strictly defined zone and does not affect the close surroundings in any way; there is no emission of gases or generated vibrations. The method can be used for both compact and easy-to-be-break rocks. The drilling direction can be vertical, horizontal or oblique. It does not guarantee rapid progress, but it enables workings development in all mining and geological conditions and is safe. To calculate load-bearing capacity of the bolt, the simplified models of rock loosening, i.e. rock loosening in the form of a cone or a pyramid (CCD method), were adopted. In the context of the range of loosening, practice shows that this is an oversimplification. The angles at the cone base, in practice, are often more than 2 times smaller than 35° or 45° . As a result, the estimated ranges of loosening, i.e. volume of the loosened solid is much smaller. To understand the loosening mechanism and the state of stress in the tearing out rock material, work under the RODEST project entitled: "Testing and modeling the mechanism of destruction of rock materials in the spatial state of shear and tensile stresses", was undertaken. The dimensions of the failure cones with respect to the tested embedment depths and rock substrates observed in this investigation are far above what results from the standard computational models (Fig. 2). The ratio of the average Z_{av} and the effective anchoring depth H_{ef} determined by the R coefficient is about 4. This is more than twice the value used for the calculation of the anchor load capacity (CCD method) where $R=1.5$.

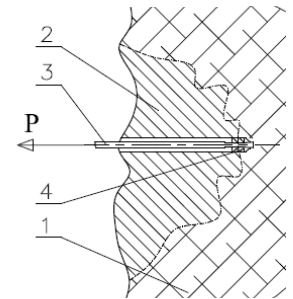


Fig. 1. Idea of mining the solid rock by destroying its cohesion; 1-rock mass, 2- loosened rock, 3-tearing out string, 4-expanding component



Fig. 2. Own tests on mechanical loosening of rocks within the RODEST project: a) test stand equipment, b) example of a cross-sections through a loosened rock, c) examples of a cross-sections through a loosened rock, specifying the effective anchoring depth H_{ef} , maximum Z_{max} , and minimum Z_{min} loosening range.

