Hval O.: 2000:
Comparison of three engineering geology rock mass classification systems, RMR, Q and RMi - experiences from practical use in the Svartdal and Tåsen tunnels. (in Norwegian)

Cand.scient. thesis, University of Oslo, Norway, 230 p.

Abstract

The study was conducted at the University of Oslo, Institute of Geology. Thesis advisers were professor Kaare Hoeg and 1. amanuensis Fredrik Löset. The study was conducted during the period 1998-2000.

The RMR rock mass classification system was developed by Bieniawski in 1973 and the Q-system by Barton, Lien and Lunde in 1974. Compared to these two systems, the RMi- system, developed by Palmstrom in 1995 is a relatively new system. Accordingly this master thesis has focused more on the RMi-system than on the other two well known and widely used systems. The RMi-system is meant to represent a further development of the existing rock mass classification systems and to provide estimates and create a data-pool for the unconfined compressive strength of different rock masses.

Extensive comparisons between the three systems have been undertaken in the thesis. The experience indicates some interesting differences in the usage of the systems, and to what extent the systems are sensitive to certain parameters. The RMi-system is more complicated to use than the other systems. At a first glance this may seem to make it less applicable to engineering problems. This problem is however overcome by the use of a spreadsheet. The use of this spreadsheet also has other advantages, as estimates of support requirements in weakness-zones can be done in a simpler way.

It is concluded that the RMi-system still needs some improvements to become more user-friendly. The author suggests how improvements in the spreadsheet for estimations of the RMi-value can be performed. It is also recommended that a manual for practical use of the RMi- system should be developed.

A table of RMi-values for a gneiss rock mass has been worked out. These values represent the uniaxial compressive strength of the gneiss rock mass as a whole, including joints and cracks. Methods for estimating the applied thickness of sprayed-concrete and the density of rock bolts used in the two tunnel-projects have also been developed.

One of the most important conclusions in this study is that the classification systems tend to recommend less conservative rock support than what has actually been used in the two tunnel projects. In connection with this there is a discussion of whether or not the applied amount of rock support in the two tunnel projects has been reasonable. Furthermore, some ideas about the use of forepoling (pre-bolting) as a part of the permanent rock support system have been put forward. Aspects of the initial rock support used, the systems' support recommendations, and final support installed in connection with three rock-falls in one of the tunnels, have also been examined.