of Canada Annual Publication.

Rock Mass Classification and Tunnel Support Design in China

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Abstract:

This paper presents and discusses the two recently established rock mass classification systems in China, namely the Basic Quality (BQ) and Host Rock Rating (HRR) systems. The establishment of the BQ and HRR rock mass classification systems in China is based on huge amount of experiences gathered in the design stages and later verified in the construction of rock tunnels and underground structures in China.

The BQ system was originally used for classification of a rock mass in terms of strength and degree of fractures only. It is empirically related to the uniaxial compressive strength of the rock and the volumetric joint count. It was later amended by applying correction factors to external conditions such as the in-situ stresses, groundwater seepage and joint orientation of the rock mass, such that supporting measures required to keep an underground opening stable could be estimated in the design stage.

On the basis of the amended BQ system and analysis of case records, China published in 1993 a rock mass classification system called HRR that has been specifically designed for underground excavation related to water resources and hydropower projects in China. Five factors relating to rock strength, rock intactness, joint conditions, groundwater conditions and joint plane orientation are used in arriving the HRR value.

The BQ and HRR systems were compared with the commonly used rock mass classification systems such as the RMR and Q systems. An examination of the all parameters in the different systems suggests that there are lots of similarities among these different systems. Most of the methods incorporate strength of the rock, geometric conditions (block size, frequency of joints), conditions of joints (spacing, size, aperture, infilling, roughness), orientation of the joints relative to opening axis, groundwater conditions and in-situ stresses etc. The major difference is the different weightings given to similar parameters and in the use of distinct parameters in one or other schemes.

Two case records have been given in this paper on the use of BQ and HRR systems for the design of supporting measures in underground excavation in China. The projects were completed successfully, verifying the support design based on the two classification systems was adequate.

Keywords: Rock Mass Classification System; RSR; RQD; RMR; Q; BQ; HRR; Compressive Strength; Intactness; Joints; Groundwater; In-situ Stresses.

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