ROCK MASS CHARACTERIZATIONS AND SAFE SUPPORT DESIGN OF POWER TUNNEL OF NANDIHAR HYDROPOWER PROJECT IN DISTRICT BATTAGRAM, KPK.

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Abstract

The current study encloses the estimation of engineering rock mass properties and safe support design of power tunnel of Nandihar Hydropower project. Empirical and numerical methods were used and compared in this study in order to achieve safe design of tunnel. The proposed length of tunnel is 6km. Detailed field studies were carried out which includes, geotechnical investigation, geological mapping, sampling and thorough discontinuity surveys. Rock mass were characterized by using two methods, namely rock mass rating (RMR), tunneling quality Index (Q). RMR and Q-system rating were determined by using field data and the mechanical properties of intact rock samples were evaluated in the laboratory. Empirically support design was calculated on the basis of RMR and Q-system rating. Geological strength index (GSI), was used to estimate geotechnical parameters of rock masses. Hoek-Brown parameters and rock constants were determined by using RocLab 1.032 (RocScience) program. Squeezing of tunnel was determined by empirical relations. Support designs were proposed according to rock mass condition by RMR and Q-system. Computer software Phase2 8.0 (RocScience), (a 2D finite element program) was used as numerical method. The parameters calculated by empirical methods were used as input parameters for numerical modeling. RMR results point out that all the rock mass situated along tunnel can be categorized as fair rock and has therefore classified in class III except at some places where it is categorized as poor rock and categorize as class IV. As per outcomes established from Q-system, rock mass along tunnel alignment belongs to very poor, poor, and fair rock regarded as in classes Q3, Q4 and Q5 respectively. According to deduction from empirical and numerical analysis, some stability issues were noticed along tunnel route specially in shear zone and at large overburden which shows significant displacement, yielded elements and plastic zone without support. In numerical modeling, subsequent to application of support (rock bolt and shotcrete) recommendation from empirical methods illustrate that there was a significant reduction in displacement, number of yielded elements and size of plastic zone. Thus comparison of two results suggests that a more reliable and safe design could be achieved by using a combination of empirical and numerical methods.