An Investigation of the Strength and Deformation Characteristics of Rock masses: A Case Study in an Excavation of Eskişehir-Köseköy Tunnels, Turkey

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Abstract

With increasing of high-speed rail technology in last decades, Turkey has developed many big engineering projects to connect major cities. Excavations conducted for these projects provide very important contributions in term of understanding the strength and deformation characteristics of weak rock masses belongs to various geological materials. The Ankara-Istanbul high-speed railway known as a significant project among these projects was designed in two different phases. To discuss the outcomes, experiences and challenging geological materials during construction of this tunnel, the geotechnical properties of rock masses of a tunnel named as T19 are evaluated and discussed in this study. The T19 tunnel was excavated in stratified and heavily fractured four different geological formations. Rock mass rating (RMR) system, and tunnelling quality index (Q) were utilized for the preliminary design stages of this tunnel. These engineering rock mass classifications were utilized in 135 different locations to find representative RMR and Q values for encountered rock masses during excavation. The RMR and Q values, which range between 18-52 and changing between 0.017 and 1.6 respectively, indicate that the T19 tunnel was mainly constructed in very poor and poor rock masses. Thus, shotcrete immediately was applied after face advance to prevent the fall of loose rock fragments and to minimize excessive deformation in rock, particular in very poor and poor rock masses. In addition, the deformation characteristics of the tunnel were also carefully monitored and measured by 3D-optical measuring system and conventional tape extensometer, and then required further supports were installed. Finally, the rock mass-support interactions of different geological formations were comprehensively evaluated in this study for understanding strength and deformation characteristics of weak and stratified rock masses.

Keywords: Convergence, high-speed rail, rock mass, support, tunnel