An attempt at model-based quantitative rock mass classification using integrated geophysical data

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Rock mass classification has been widely used for designing and constructing engineering structures such as tunnels and dams. There are several classification methods proposed such as RMR and Q-value. As these methods, however, are somewhat qualitative and subjective, it has been long recognized that the rock mass classification thus obtained strongly depends on the engineers who make classification. We have, therefore, studied a classification method which can more quantitatively and objectively classify the rock mass grade with multiple geophysical data based on rock physics.
This proposed method applies rock physics models to multiple geophysical data measured in the rock mass for relating them to the rock mass grade. In this study, seismic P-wave velocity and resistivity measured in a few boreholes on a planned tunnel route are modeled with the shaly sand model as an effective medium model for seismic velocity and Glover's equation for resistivity to estimate the relationship between these geophysical properties. Then RMR measurements with rock core samples obtained in the same boreholes as geophysical logs are compared to the geophysical data through the estimated relationship in order to have a rock mass classification map with geophysical data. Using the map, a rock mass classification of the rock mass along the tunnel formation is obtained and evaluated through comparison with the conventional classification. This comparison clearly proves feasibility of the proposed method in practical use.

Keywords: rock mass classification, integrated geophysical data, rock physics model

