Model-based quantitative prediction of seismic velocity reduction in the excavation disturbed zone (EDZ)

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It is important to properly characterize the excavation disturbed zone (EDZ) in excavating tunnels and underground caverns for their designs and constructions. Seismic velocity in the EDZ is particularly important because it is commonly utilized for rock mass classification of the tunnel, which is directly related to design and cost estimation for its construction. We, therefore, have applied rock physics models to seismic velocity for quantitatively predicting seismic velocity reduction in the EDZ. The Kuster-Toksoz model (the K-T model) which has been widely used as an inclusion model was applied to seismic velocity data measured in the EDZ. P- and S-wave velocities were calculated assuming that the rock in the EDZ becomes unsaturated due to groundwater dissipation and its crack density increases due to in-situ stress release around the tunnel. Calculated seismic velocities with the proposed model were compared with the seismic velocities measured at tunnel walls of a mine and an underground research laboratory (URL). These comparisons reveal that the proposed model can represent seismic velocity features in the EDZ that P- and S-wave velocities are reduced in the same manner for fresh rocks, while P-wave velocity is reduced largely as compared to S-wave velocity for weakly weathered rocks.

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