The Effect of Weak Layers Intersecting Diagonally with Tunnel on Tunnel Floor Heaves

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It is well known that floor of tunnels often heaves at the intersection with a weak layer. Therefore, we conducted a study focusing on the effect of the angle and position in which the weak layer intersects with the tunnel on floor heave. A case study was conducted on tunnels that had recently experienced floor heave. The results showed that the amount of vertical displacement of the invert excavation surface during tunnel construction is large in areas with fractured strata and a high slaking index. This is particularly the case in areas where such strata extend below the invert at a gradual gradient. Laboratory tests showed that rocks taken from strata with many fractures are more susceptible to deterioration due to water absorption and are more likely to deform. Furthermore, we were able to reproduce the above tendency using numerical analysis. In order to suppress floor heave in the tunnels, it was found that it is important to select the structure of the invert taking into account the angle and position at which the tunnel intersects with the weak layer.