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The evaluation of support performance for tunnels with different diameters excavated in weak graphitic shists

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2. stage (İnönü-Köseköy) of Ankara-İstanbul High-Speed Train Project (YHT) is 150 km-long and includes 25 tunnels with total length of nearly 58 km. The 7765 m-long part of these tunnels between Bozüyük and Bilecik was excavated in the metamorphic units of Pazarcık Structural Complex which have different thicknesses and form horizontal and vertical transitions to each other. The folded weak graphitic schists with thin schistosity planes affect the tunnel support performance negatively.
In this study, the tunnels with 13.5, 8.2 and 4 m-diameters excavated in the weak-very weak graphitic schists by the conventional methods and the reasons of the problems (overbreak, deformation higher than estimated, wreckage etc.) are examined. The most common problems in the tunnel construction are overbreak and deformations higher than estimated before.
Upsizing the fore-polling diameters, injection with pressure and carving the tunnel face were the first applied methods for decreasing the overbreak in the wide tunnels. Although these methods decreased the overbreak, the deformations in the tunnel couldn't be prevented. In this context, the data derived from the rod and tape extensometers was examined, the elastic and plastic zones were determined, the creep behaviour was locally observed on the support elements during 65 days. Also the mass parameters (GSI, weight per unit of volume, uniaxial compression, modulus of elasticity, modulus of deformation etc.) of the weak-very weak rocks were evaluated again.
By the help of the compiled data it was determined that when the tunnel diameter increases, the deformation and overbreak increase. For example, while there are approximately two overbreaks at each 100 m in a 4 m-diameter tunnel, it is three in a 8.2 m-diameter tunnel and six in a 13.5 m-diameter tunnel. The deformations were estimated as 8 cm in a 4 m-diameter tunnel, 15 cm in a 8.2 m-diameter tunnel, 20 cm in a 13.5 m-diameter tunnel. However they are respectively 7.1, 15.8 and 31.9 cm. On the purpose of decreasing the stability problems during excavation, it was concluded that the excavation should proceed step by step as long as the diameter increases and the time connected rock mass behaviour should be examined in order to determine the weak-very weak rock mass support system.