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Highway Upgrade Impact on Historical Pedestrian Tunnel

Ahmed Fahmy
AECOM
NJ, USA
ahmed.fahmy@aecom.com

Extended Abstract

A modification to an existing roadway overpassing a historical pedestrian tunnel built in the 1800's is planned for construction. The pedestrian tunnel is approximately 1000ft long and of varying elevation, with the deepest point located at approximately 175ft below the existing ground surface. The proposed upgrade comprises an increase to the traffic loads and therefore possibly inducing additional stresses to the tunnel structure. The latter was installed in rock overlain by a deep fill layer. Given that most rock foundations behave as linear elastic materials within the expected stress range, a preliminary calculation was first performed using the elastic theory to evaluate the distribution of induced stresses in rock adjacent to the subject tunnel (Wyllie, 2003). The analysis was performed using conventional approaches (e.g. Bounssinesq approach..etc). This assumption has been previously verified by multiple studies whereby the elastic theory reasonably predicted the actual (measured) stresses in loaded rock mass (Morgan & Scala, 1968) (Bozozuk, 1972). Two and three-dimensional finite element analyses were then performed using the software Plaxis (Brinkgreve, et al., 2016) where the variation of the induced stresses in the tunnel section was estimated.

The results showed that the induced stresses are within the acceptable range. The results, however, showed a noticeable difference between the limit equilibrium and finite element simulation results, where the latter appears to provide a more conservative estimation of the induced stresses in the rock mass surrounding the subject tunnel. Discussion of the observed difference between the different methods ate different loading conditions is provided in the current study

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