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Stability Analysis of Rock Tunnel Subjected to Internal Blast Loading

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Abstract : Underground structures are an integral part of urban infrastructures. Tunnels are being used for the transportation of humans and goods from distance to distance. Terrorist attacks on underground structures such as tunnels have resulted in the improvement of design methodologies of tunnels. The design of underground tunnels must include anti-terror design parameters. The study has been carried out to analyse the rock tunnel when subjected to internal blast loading. The finite element analysis has been carried out for 30m by 30m of the cross-section of the tunnel and 35m length of extrusion of the rock tunnel model. The effect of tunnel diameter and overburden depth of tunnel has been studied under internal blast loading. Four different diameters of tunnel considered are 5m, 6m, 7m, and 8m, and four different overburden depth of tunnel considered are 5m, 7.5m, 10m, and 12.5m. The mohr-coulomb constitutive material model has been considered for the Quartzite rock. A concrete damage plasticity model has been adopted for concrete tunnel lining. For the trinitrotoluene (TNT) Jones-Wilkens-Lee (JWL) material model has been considered. Coupled-Eulerian-Lagrangian (CEL) approach for blast analysis has been considered in the present study. The present study concludes that a shallow tunnel having smaller diameter needs more attention in comparison to blast resistant design of deep tunnel having a larger diameter. Further, in the case of shallow tunnels, more bulging has been observed, and a more substantial zone of rock has been affected by internal blast loading.

Keywords : finite element method, blast, rock, tunnel, CEL, JWL
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