Abstract

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Behavior of Steel Lining of a Vertical Sidewall Tunnel in Rock Media under Explosion Loading

Due to the progressive development of military destructive weapons such as conventional weapons, a consequence development of the fortified structures is essential. One of the most important types of the fortified structures is tunnel in rock media. The basic premise of this work is studying the response of tunnels in rock-media exposed to high explosion loads, which help tunnel designers and military engineers in estimating displacements, stresses and over all damage in the tunnels due to wave propagation generated by that explosion loads. In this study, the tunnel steel lining for a vertical sidewall cross-section tunnel is studied for different rock types. 2500 kg TNT was used as an explosive load. This charge was located at 3.25 m bellow ground surface. The distance between charge and tunnel crown was fixed to 10 m for all models. Regard to finite element solution, an appropriate mesh is employed to represent the geometry of the problem. The rock and lining are simulated by solid elements (one quarter of the domain) in a three-dimensional finite formulation. Joint to joint are used to simulate rock-lining interaction. The steel lining thickness to arc radius (ts/R) ratio was considered 1/300, 1/150, 1/100, 1/75 and 1/30 for ts1, ts2, ts3, ts4, ts5, and ts6 respectively. Von-Misses material model is used to simulate the behavior of steel lining. Grade 50 of steel is used where yield stress is 360MPa and the strength is 468.4MPa, modulus of elasticity equal to 210000 MPa, elongation equal to 12%. The response of displacements and stresses, for all rock types and tunnel spans are determined at different lining points.