EXPERIMENTAL AND NUMERICAL,INVESTIGATION OF BLAST WAVE PROPAGATION IN TUNNELS

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The objective of this report is to present a system of mathematical functions which allow the calculation of the blast parameters and the pressure time history in tunnel systems when cylindrical HE charges are detonated in the tunnel entrance, or within +-5 tunnel diameters from that point (see fig. 1). In order to define the blast loading on blast doors or ventilation systems of an underground shelter, it is necessary to know how a blast wave propagates through a branched tunnel system. This includes L- and T-turns, closed pockets, connections with rooms of different shape and size, etc.

Several small scale model experiments, with different configurations, were performed. The correspondence to full scale tests as well as the independence of the cross-sectional area are proven. In addition, numerical calculations with the code AUTODYN were conducted to validate the code. Comparison of measured and calculated pressure time curves provides a quality check on the numerical calculations (see fig. 2 for the detonation of a sloped cylindrical charge in front of the tunnel entrance).

Application of the blast program demonstrates the wide range of validity for all main components of an underground structure. For planning underground tunnel-room systems in which blast loading effects are to be minimized, a program of this kind can be economically advantageous because several parametric combinations can be investigated in the engineering stages of development.