AIRBLAST PROPAGATION IN TUNNELS WITH OBSTACLES: EXPERIMENTAL INVESTIGATION AND NUMERICAL CALCULATIONS

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The tremendous developments in non-nuclear weapons technology in the near past emphasize the importance of the threat to protective structures threat due to conventional weapons effects. For the case of the detonation of a conventional weapon at the entrance of a tunnel or in the tunnel itself, knowledge about the propagation of short duration blasts (as compared with nuclear ones) in tunnel and tunnel systems is scarce. Therefore the NC-Laboratory Spiez started an experimental and numerical research program in order to investigate more thoroughly such configurations.

The first part of the paper deals with the experimental investigation of the influence of obstacles on the blast propagation in straight tunnels by means of small scale models. Three different cross sectional ratios of the obstacles were used (0.25, 0.5 and 0.75). The pressure time histories have been measured at different locations after one as well as two obstacles in series, where the obstacles were either in a row or opposite.

The second part of the paper presents the results of numerical calculations performed with the two dimensional FD-hydrocode AUTODYN-2D. Although this code is limited to 2D configurations, appropriate modeling allows to use it with success also for simple quasi-3D configurations as encountered in the vicinity of the obstacles. The comparison of the numerical results with the experimental ones shows an excellent agreement especially after a distance of 2 or more tunnel diameters away from the obstacles.

Generally speaking we observed that obstacles like baffles, all kind of plates and screens, cause a reduction in overpressure, whose value is largely determined by the ratio between blocked cross section and total cross section. However, such obstacles provoke also reflections which lead to recovery and amplification of the ongoing airblast by this greatly reducing the expected attenuation.