BLAST WAVE ATTENUATION IN TUNNELS AND EXPANSION CHAMBERS CONTAINING DISCRETE ROUGHNESS ELEMENTS

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The attenuation of blast waves as they pass along tunnels, ducts and expansion chambers has been the subject of a number of recent studies whose aim has usually been to identify means of providing protection to a sensitive facility. Such studies have generally concentrated on smooth-walled tunnels and chambers or those which have relatively small-scale distributed wall roughness. This paper presents the results of an investigation into the attenuation of blast waves along tunnels and through on chambers which have seen equipped with relatively large-scale discrete roughness elements.

A small shock tube was used to provide a repeatable simulated blast wave pressure-time history which became the input waveform to a scale model of either a straight tunnel or an expansion chamber. Measurements of overpressure-time histories for locations both along and at the closed far end of the tunnel and expansion chamber were made. Experiments were first carried out with roughness elements absent to establish a basis for comparison. When roughness elements (in the form of baffle-plates of differing geometry) were installed, they effectively reduced the cross-sectional area of the tunnel or chamber. These elements were uniformly-distributed along the tunnel in both symmetrical and staggered arrangements. In the case of the expansion chamber, up to five baffle-plates could be installed for any one experiment.

In an attempt to correlate the results from experiments that involved a range of different configurations a non-dimensional 'attenuation coefficient'' based on system geometry was developed. Graphs of non-dimensionalised peak reflected overpressure and reflected overpressure impulse measured at the end of the tunnel and at the back wail of the expansion chamber were produced. From such information the effect of the different discrete roughness elements could be assessed and Potential attenuation geometries identified that would provide good protection yet still allow access to the facility.