BLAST EFFECTS MODELLING IN A PASSENGER BUS

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This paper presents a methodology for the assessment of the blast environment inside and outside of a passenger bus due to an internal explosive detonation. It addresses the mathematical modelling and Computational Fluid Dynamics (CFD) simulation of blast wave propagation in the bus taking into account the effect of venting due to progressive breakage of glass windows and doors. The pressure-impulse diagrams, traditionally used as criteria for the failure of glazing elements, are encoded by a dynamic equation for accumulated damage. The bus windows and doors are modelled using special frangible elements and removed from the computational domain once the accumulated damage reaches some threshold value. Three-dimensional numerical simulations are used to carry out parametric studies of the influence of the strength of bus windows on the blast pressure-time histories at various locations inside and outside the bus. As is expected, weaker windows better protect the bus passengers and the driver at sufficiently large stand-off distances from the explosive charge but make people outside the bus more vulnerable, particularly when the effects of window fragmentation is included. Using the proposed methodology, the critical explosive charges for the selected passenger bus designs can be determined. Experimental data from an instrumented live fire bus blast is included to validate the CFD overpressure predictions and to illustrate the actual failure of glazing elements.