MASONRY CUBE STRUCTURE BENCHMARK TESTS – HYDROCODE SIMULATIONS

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For structures under shock and impact loading, numerical simulation software has proven to be extremely useful. Hydrocodes have become a rapid and cost-effective tool for understanding and predicting response of real systems and scenarios. There is an interest in continuing the development of such codes to predict the break up and trajectory of debris for Explosive Store Houses (ESH). Once fully validated, numerical modeling techniques could form the basis for numerical experiments that could be used to conduct sensitivity studies quickly and cheaply.

To validate the tools available and to provide a benchmark to more complicated structures, the Defence Ordnance Safety Group has devised a series of tests to investigate the break-up dynamics of simple single leaf masonry structures.

Each masonry cube structure, of $8m^3$ internal volume, is built on a reinforced concrete slab base. Two variants have been selected, one with a reinforced concrete roof and one with no roof, to allow the effects of confinement to be investigated. Cylindrical charges (l/d=1) of PE4 were positioned and initiated centrally within the structures. Charge sizes of 24kg and 8kg have thus far been investigated giving loading densities of 3 and $1kgm^{-3}$ respectively.

This paper will describe numerical simulations of these trials using the commercially available hydrocode ANSYS AUTODYN. These simulations will model the detonation of the charge, the expansion of the products and development of the blast wave, and the interaction of the blast with the structure. The response of the structure will be compared with the trials data. Different strategies for coupling the structure and the fluid domain are also investigated, showing that a fully coupled fluid structure interaction is required particularly for a more confined geometry with a roof.