STRONG EXPLOSION NEAR A CONVEX STRUCTURE: A MULTI-SCALE EXPERIMENTAL STUDY

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A thorough understanding of blast effects generated either by accidental or terroristic explosions is necessary to assess the vulnerability of surrounding structures. A well-described literature technique consists in performing experimental simulations on a smaller scale. This technique provides easy access to a large amount of experimental data at a reduced cost, but it however requires the validation of the scaling laws necessary to extrapolate conclusions for larger or full scale configurations.

IRSN and ISL have designed two experimental configurations for this study: 50g (IRSN configuration) and 400g (ISL configuration). TNT equivalent charges were respectively detonated, on ground level, in the vicinity of a reference solid hemi-cylinder, representative of considered convex structures.

In IRSN configuration, blast pressure profiles generated by 42g Hexomax^R charges were measured using different sensors among different types of technologies (Kistler, Kulite and PCB). Depending on the geometric position of each measurement, the different sensors responses are discussed to provide general recommendations. In addition to free-field propagation, blast loads on the surface of the hemi-cylinder are analyzed (Mach stem development).

In ISL configuration, blast loads generated by scaled-up 400g TNT charges were recorded as in IRSN configuration and also using the same set of gauges, with and without the hemi-cylinder. Other explosive compositions (Hexomax^R, C-4 and Comp-B) charges were sized to 400g TNT equivalent. Blast parameters (overpressure, impulse, arrival time, Mach stem development) were consequently compared to TNT charges and also analysed through the principle of scalability between the two dimensional configurations for the Hexomax^R charges.
These results provide design guidance for small scale blast experiments.