Numerical Simulation of the response of quadrangular plates to buried charges

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Reports on the failure of plates, beams and shells subjected to **blast loading in air** have been widely presented by numerous researchers with a view to understand the large permanent ductile deformation and rupture of these structures, the effect of boundary conditions (clamped or built-in) and the loading conditions (uniform – over the entire structural area or localised – over a central area of the structure). With landmine being a major threat worldwide, it has become important to investigate structural response to buried charges to efficiently develop protection systems. Consequently, focus on the effects of buried charges on structures has increased worldwide. The effect of buried explosives on a structure compared to air blast response adds more complication to an existing complex mechanism. There exist numerous mechanisms and parameters such as depth of burial, the standoff distance and the mass of explosive that are responsible for delivering impulse to a structure subjected to buried charges. This paper presents the results of numerical models, developed in ANSYS/AutoDYN R12a, simulating a series of experiments that was carried out to investigate the response of quadrangular steel plates to **explosive charges buried in dry construction sand**. The depth of burial, the standoff distance and the mass of explosive were varied to provide a range of plate response. The models, validated against the experiments, provided insight into the transient response of both the plates and the dry construction sand. The numerical models indicated that for most of the tested stand-off distances the sand did not impact the plate as an ejecta but as a sand dome with complete containment of the detonation products. The sand serves to focus the high pressure and high temperature detonation products into the structure. This focussing effect increases with the depth of burial. The mechanism for plate deformation is dependent on the amount of energy the sand can absorb (via compaction) which is directly proportional to the depth of burial.