NUMERICAL ASSESSMENT OF DAMAGE PRODUCED BY BLAST LOADS ON MASONRY CONSTRUCTIONS

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ABSTRACT

When an explosion takes place outside a building, envelope masonry walls result seriously affected by overpressures originated in the detonation. On the other hand, the masonry debris originated by the collapse of structural and non structural elements may be lethal for people safety inside the building. Iso-damage curves for the assessment of damage in structural and non structural elements can be found in literature. These curves have been obtained from both experimental and actual explosions and seem to be an attractive way to relate pressures and impulses to damage produced in different types of buildings and parts of them. Nevertheless, they are only indicative of damage levels and they cannot be used to assess actual blast damage on a masonry constructions or to infer the amount of explosive used in a blast attack from buildings damage. Numerical simulation of the problem is nowadays a useful tool for these purposes. However, appropriate calibration and validation of the numerical tool and material models are needed in order to properly reproduce masonry behavior under blast loads.

Numerical simulation of the effect of blast loads on masonry constructions performed with an hydrocode is presented in this paper. The effects of mesh size, different materials models used for masonry and erosion algorithm on damage results are discussed. Comparison of numerical results with available experimental results that corroborate the ability of the numerical model to reproduce actual masonry damage is also presented. Variable configurations, support conditions and openings under different blast loads at different locations are numerically simulated and the resulting damage patterns are compared. Useful conclusions to improve first blast damage estimation based on iso-damage curves can be obtained from these comparisons.