EXPERIMENTAL VALIDATION OF CFD SOLVER FOR PREDICTION OF BLAST LOADING IN AN URBAN ENVIRONMENT

Fabio Lozano[1], Morgan Johansson[1,2], Joosef Leppänen[1], Mario Plos[3]

[1]*Chalmers University of Technology, Gothenburg, SE-41296, Sweden*
[2] *Norconsult AB, Gothenburg, SE-41755, Sweden*
[3] *Swedish Transport Administration, Gothenburg, SE-41104, Sweden*

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Abstract:
The evolution and propagation of a blast wave in urban environments differ substantially from those of free-field blast waves. The interaction of the blast wave with obstacles along its path gives rise to physical phenomena such as reflection, diffraction and superposition which significantly increase the complexity of the loading. Therefore, for such environments, simplified engineering tools commonly used for predicting shock wave parameters in free-field settings are not sufficient. Indeed, to properly estimate the characteristics of the blast loading for such cases, it may be necessary to use more advanced tools based on computational fluid dynamics (CFD). However, CFD codes must be validated against experimental data before they can be implemented in real life cases. In this study, the open-source CFD solver blastFoam [1] was validated against a scaled (1:5) experimental campaign of an explosion of PETN at a street intersection. The setup of the experiment consisted of four concrete boxes arranged in a 2×2 layout. Multiple locations of the charge were tested. In general, very good agreement between the experimental results and the blastFoam simulations was obtained. The study showed that blastFoam was able to describe the arrival and amplitude of both the main shock wave and secondary waves with a good level of accuracy at multiple points in the configuration.

[1] blastFoam: An OpenFOAM Solver for Compressible Multi-Fluid Flow with Application to High-Explosive Detonation (2019). Synthetik Applied Technologies, LLC.