PERSONNEL VULNERABILITY PREDICTIONS USING SMALL-SCALE AIR BLAST MODELING

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The ability to predict the vulnerability of personnel to blast is of particular importance in urban settings where modeling tools are essential to mitigating blast hazards using barriers and planning evacuation routes for bomb threats. This paper presents a new study to validate CFD modeling against data from small-scale experiments for blast loading of structures in order to make assessments of personnel vulnerability. A previous study [1] validated the Chinook CFD code air-blast capability against small-scale experiments relevant to relatively weak far-field loading. The experimental trials were performed using the CERL blast table [2], which was specifically designed for urban blast studies at a laboratory scale. The present study looks at additional CERL data for a small-scale model urban scenario with regard to mid-field blasts, where overpressure and duration are sufficient to cause human injury. The purpose of the present investigation is to perform a detailed study of critical locations in urban layouts, such as in corners, along channels and behind structures. An optimal computational mesh is sought by increasing local mesh resolution in regions of interest to more accurately capture shock wave behaviour. The ability to predict the correct shock waveform in urban street configurations is of significance to personnel vulnerability calculations, where incident and reflected shocks can have a compounding effect and lead to accumulated damage. The present work focuses on correctly capturing wave physics in complex urban geometries, and demonstrating close agreement between experiment and numerical modeling results. The output from this simulation will be a personnel vulnerability distribution for the full-scale geometry. The approach is readily applicable to additional and future vulnerability models using data from the numerical simulation. Following validation of the CFD blast loading capability, subsequent development will address incorporating advanced personnel vulnerability injury assessment concepts that account for the obstruction and loading of individual personnel within the CFD mesh.

References

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