APPLICATION OF RAPID CITY PLANNER TO HISTORICAL WORLD EXPLOSION EVENTS

R. C. Ripley[1], N. McCormick[1], L. Donahue[1], F. Zhang[2]

[1]Lloyd's Register Applied Technology Group, 1888 Brunswick St. – Suite 400, Halifax, NS, B3J3J8, Canada; [2]Defence R&D Canada – Suffield Research Centre, PO Box 4000, Station Main, Medicine Hat, AB, T1A8K6, Canada

Key words : Urban explosion – Enhanced blast – Structure damage – Fast models

Rapid City Planner is a modeling and simulation (M&S) tool for assessment of the urban explosion effects from conventional weapons and explosive devices including improvised explosive devices (IED) and home-made explosives (HME). The tool provides a fast, accurate, and easy-to-use explosive threat prediction capability in a geographic-based environment for application in real-world cities. In this paper, Rapid City Planner is applied to studies of three historical events: 1) Halifax Explosion disaster in 1917 involving a munitions ship loaded with military explosives and ammunition equivalent to an estimated 2.9 kilotons of TNT, 2) Oklahoma City bombing in 1995 involving a vehicle with an estimated 2.2 tons of improvised explosive, and 3) Oslo attack in 2011 involving a vehicle of 950 kg of improvised explosive material. The models were created using open-source 3D city data and the blast calculation was solved using the Rapid City Planner automated first-principles CFD technology. Numerical results computed on a stand-alone laptop are compared with the high-fidelity CFD results from the Chinook code, and show increased accuracy and dramatic reduction in computing time. The structure damage determined with Rapid City Planner is compared with historical evidence and published data to demonstrate the validity and overall applicability. Scientific assessment capabilities are used to compare the urban effects between the three unique world events, including degree of confinement, enhanced blast due to explosive afterburning, and load enhancement ratio due to urban reflection. The fast running, predictive M&S capability of Rapid City Planner for real-world explosion events is further demonstrated through the urban effects of cased charges and explosive dispersal of chemical, biological and radiological materials.