BLAST WAVE INJURY PREDICTION MODELS FOR COMPLEX SCENARIOS

J.C.A.M. van Doormaal[1] and J.A. Teland[2]

[1] TNO, Lange Kleiweg 137, 2288 GJ Rijswijk, The Netherlands; [2] Norwegian Defence Research Establishment (FFI), Postboks 25, 2027 Kjeller, Norway

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Blast waves from explosions can cause lethal injuries to humans. Development of injury criteria has been ongoing for many years, but with the main focus on free field conditions. However, with terrorist actions as a new threat, explosions in urban areas have become of much more interest. Urban areas provide a complex environment for blast wave expansion, thus increasing the difficulty of the injury and lethality prediction. The increased potential for injury due to the interaction of blast waves with reflecting surfaces (walls or other obstacles) has not received significant attention to date.

TNO and FFI have started a research study to the topic of blast injury in complex environment. This research has the goal to come up with the most appropriate injury criterion and to develop a quick analysis procedure, as simple as possible.

A literature survey has been performed resulting in an overview of available models, and the applicability of these models. The Axelsson model was found to be the most promising for the objectives. It can predict the injury of the air-filled organs in both complex and free-field blast situations. Unfortunately it involves a cumbersome BTD-procedure, requiring four pressure signals on a so-called Blast Test Device as input. However a new method to avoid the BTD has successfully been developed. We call this the single point (SP) method.

Also, the basic assumptions of the Axelsson model have been studied in detail. It was found that the calibration of the model to injury data is based on some questionable pressure measurements. In this case, numerical simulations can be used to correct the pressure data. With the original test data (configuration and injury levels) at hand, we have simulated the different scenarios in Autodyn. The new pressure data was used to recalibrate the chest wall response – injury correlation. The updated correlation is consistent with the SP-approach.