STANDARDS AND STRATEGIES FOR BLAST TESTING OF STRUCTURES AND DEVICES

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Blast-resistant structures and devices are an increasingly common design requirement for various stakeholders that perceive themselves to be at risk from explosion events. Government and financial institutions, the military, and industrial facilities are just a few examples that require protective features. Since theoretical methods of analysis can be too complex to be practical and require validation, and approximate methods are limited in their applicability, the testing and certification of protective structures and devices is often the preferred and/or necessary avenue.

Consequently, field tests are often conducted to evaluate and/or certify new products for blast resistance. Such experiments can be performed on full-scale or scaled specimens and, frequently, several test specimens are exposed to blast loads simultaneously in an 'arena' configuration. However, field tests present the researcher with a number of challenges, such as low repeatability and inconsistent real-time data collection. Ideally, best practice guidelines and test standards should be followed to minimize the risk of errors and ensure experimental consistency. Although a number of testing standards exist, their focus is mainly on blast-resistant windows and doors and, in general, do not provide guidelines to maximise the quality of experimental data collected. Therefore, there is an ever-increasing need for the development of guidelines for field experimentation.

Alternatives to field blast experiments, such as shock tubes or blast simulators can, in certain cases, alleviate the need for conducting field tests and improve data quality and repeatability. Naturally these devices have limitations and do not completely replicate the effects of a blast. As a result, there is also a need for best practice guidelines for laboratory experimentation and criteria to evaluate the applicability of these techniques.

This paper reviews the standards and techniques used in field and laboratory blast tests as well as best practice strategies to obtain consistent quality data. Topics related to specimen design and preparation, instrumentation techniques, data acquisition and testing logistics are discussed. The goal is to establish the foundation for generally accepted guidelines for testing of structures and devices. The best practices developed and presented are then exemplified using the knowledge gained from actual recent field tests, some of which are planned for the summer of 2012. It is envisaged that the guidelines presented herein will aid blast specialists when they plan, conduct and evaluate future blast experiments, leading to more reliable and better quality experimental results.