EXPERIMENTS AND ANALYSES OF EXPLOSION AT AN URBAN INTERSECTION

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ABSTRACT

Predicting the load caused by a propagating blast wave in urban environment is a complex task. For many load cases engineering tools based on empirical data or semi-empirical methods, is sufficient. However, when the geometry gets more complex, it might be necessary to use so-called hydro code programs to calculate the effect of the blast wave. Hence, there is also a need to verify such programs against experimental results. Once validated, though, such programs may be used to better understand the effects of blast load in complex load situations.

In order to validate the results from the hydro code AUTODYN™, an experimental test series, scale 1:5, simulating an explosion in urban environment, was carried out. A simplified intersection built up of four concrete boxes, dimension 2.3 m, with a total of eight charges, 0.4 and 1.6 kg of PETN, detonated at various locations were registered using 25 pressure gauges. Numerical simulations were carried out in AUTODYN prior to the experimental test series. In order to handle the simulations, and thus decrease the calculation time needed, an automatic remapping procedure, in which the progress of the shock front was automatically taken into consideration, was developed. To compare experimental and numerical results In addition, a coherence measure was introduced. Out of almost 200 compared pressure-time relations about 65 % reached $Coh \geq 0.5$; i.e. a limit that indicates very good agreement. Consequently, it is concluded that AUTODYN manage very well to predict the blast load obtained in a complex urban environment and that it may provide a powerful tool for further blast load studies.

An approach for a simplified technique, using superposition of several incident shock waves, to estimate the blast load in a more complex environment is presented and compared to the experimental and numerical results. This simplified technique is a rather crude instrument when compared to Autodyn. However, it still provides a general idea of which blast waves sums up the resulting pressure time history, and hence may be used in an early stage to approximately describe the resulting loads on a structure. The results presented herein yield a discrepancy of the positive and negative impulse intensities of only about 20 % compared to that in the experiments.