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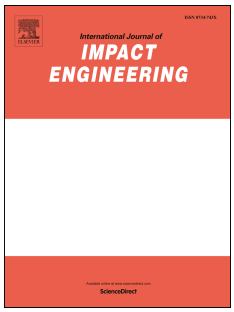

Demonstration of Tailored Impact to Achieve Blast-Like Loading

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Demonstration of Tailored Impact to Achieve Blast-Like Loading

A. Freidenberg, A. Aviram*, L. K. Stewart**, D. Whisler, H. Kim, G. A. Hegemier

Abstract

Investigation of blast loading using mechanical devices is a viable alternative to field testing with live explosives. Using impact to simulate blast-like loads has been shown to generate repeatable loading similar to field testing with live explosives, and impact loading has the advantage of high speed camera data that is not obscured by a fireball. It is demonstrated that the UCSD Blast Simulator has the capability of generating blast-like loading on civil structures by using hydraulic rams, in which the loading is tailored in two ways. First, the careful regulation of the hydraulic pressures and valve opening/closing allows the impact to be adjusted so that the peak loads and duration of the load can be controlled. Secondly, the presence of a polyurethane material at the front of hydraulic rams determines the shape of the loading that is applied to the test specimens. These two key characteristics of the Blast Simulator, which govern the pulse duration, shape, and impulse associated with impact, are referred to as the *punch* and the *programmer*. The experimental data processing methodology relating to the *punch* of the hydraulic rams is described, along with a brief description of the rubber *programmer* material. The results of a major Blast Simulator test are shown, as well as the description of a method for incorporating all relevant aspects of the *punch* and the *programmer* into a corresponding high fidelity computer simulation. Finally, the results of this Blast Simulator test are compared to a corresponding field test using live explosives in order to demonstrate the capability of the Blast Simulator to generate blast-like loading.

Keywords: Blast Simulator, hydraulics, pulse shaping, tailored impact, field test

1. Introduction and alternative testing methods

The UCSD Blast Simulator [1] is a US Federal Government-sponsored apparatus that utilizes hydraulic actuators in order to simulate blast-like events (Fig. 1a,b). The objective of this paper is to demonstrate the ability of the Blast Simulator to generate impulsive loading on structures that is similar to blast loading. This is demonstrated through a comparison of a Blast Simulator test, a high fidelity computer simulation, and a field test. This paper describes the two characteristics of the Blast Simulator that enable it to generate impulsive loading. First, the careful regulation of the hydraulic pressures and valve control allows the impact to be tailored in a way such that the peak loads and duration of the load can be

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