Shock Loading Experiments On Concrete

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On detonations or hypervelocity impacts concrete structures are loaded with shockwaves. These shockwaves cause a steep increase in pressure within the wavefront which propagates at high velocity. For a numerical simulation of such process a constitutive material law is needed which adequately describes concrete under these conditions. As basis for such a constitutive law tests on concrete under explosive loads were performed and different material parameters were investigated.

We report our approach to measure material parameters during tests with different explosive charges on concrete. We got first experience in using a new temperature sensor, called the atomic layer thermopile, to measure the temperature raise caused by the adiabatic compression. This sensor was developed for performance measurement of high energetic laser pulses. The mode of operation of this sensor is based on the temperature gradient between the sensor surface and the base of the device. Very fast response time is possible, because there is no need of getting a complete heat transfer from the ambient concrete temperature to the whole sensor. Responsible for the output voltage proportional to the temperature rise is the thermal Seebeck-effect which can be splitted in a longitudinal and a transversal component due to the orientation of the layers.

For stress measurement manganin gauges and for strain measurement ordinary strain gauges were used. For the application of these methods at high velocity loads in concrete special encapsulations are needed in order to save the functionality and to provide fast rise times of the output signals. Results of the measurements will be shown and remaining problems will be discussed.

Homeland Defense Technologies

Hardening Facilites

Mr. Gary Kehoe, Chief Security and Law Enforcement, North Atlantic Division, US Army Corps of Engineers

Abstract not available at time of publication

SDOF Code Development For Analyzing Structural Systems Under Blast And Impact Loads

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Protective structures are designed to resist extremely severe dynamic loads that most other structures would never encounter. Due to these extreme loading conditions, it is often necessary to use structural members that are much thicker than those used in typical applications, such as deep and intermediate reinforced concrete slabs. Because reinforced concrete slabs with large span-to-depth ratios, i.e., slender slabs, are commonly used in structural applications, resistance functions for slender one-way and two-way slabs have been well established. However, since slabs with small span-to-depth ratios, deep slabs, are rare in most typical structural applications, resistance functions for deep slabs are not as well defined or accepted as those for slender slabs.

SAVIAC

Shock and Vibration Information Analysis Center

Abstracts

74th Shock & Vibration Symposium

NAVSEA CRANE Surface Warfare Center Division

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Engineer Research and Development Center

October 26 - 31, 2003
San Diego, California

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