THE DYNAMIC BEHAVIOR OF FULL SCALE RC PLATES UNDER SHORT DURATION IMPACT – LABORATORY AND FIELD TESTS

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ABSTRACT

The conventional method for investigating the behavior of concrete structures under short duration dynamic loads is by conducting high explosive (HE) field tests. This approach requires the construction of complex structures and measuring systems, it provides results with relatively low repeatability and is very expensive.

The present study conducted in the Protective Technologies Research and Development Laboratory of the Department of Mechanical Engineering at Ben Gurion University of the Negev. The research in the laboratory was focused on the investigation of the behavior of materials and basic structures under blast wave loads aiming at finding ways to reduce the damage caused by the blast. The research is done with a *400 kg* pendulum experimental system that can impact large structures. The experimental investigation is supported by numerical simulation capabilities to simulate the behavior of these structures under the dynamic loads. With the pendulum apparatus the test parameters can be controlled. By varying the drop-height, the pendulum-weight and the impactor-material, different impact loads are achieved. A high-speed high-resolution data acquisition system is used to monitor the behavior of the test model and the pendulum performance. The system measures the load imposed by the pendulum, and the test model response by measuring its accelerations, displacements and strains. The results of the pendulum experiments are used to calibrate and validate the numerical simulations. Once these numerical codes are validated, one can use them to simulate the behavior of full-scale structures under dynamic loads, such as explosions.

Several tests with different parameters were conducted at the laboratory using the pendulum apparatus. These tests were done on bared reinforced concrete (RC) slabs and on RC slabs protected by aluminum foam. The aluminum foam absorbs part of the energy, and therefore reduces the RC slab damage. Numerical simulations that were calibrated using the experimental results followed these tests.

In addition, HE field tests were conducted on several RC plates under the auspices of the IDF's professional engineering units. Aluminum foam was used in some of those experiments in order to examine the potential of the aluminum foam in reducing the blast damage. The measured displacements and strains of the RC plates will be used for the validation and calibration of the numerical codes.

Significant reduction in the measured impact between the RC plates with (protected) and without (unprotected) the aluminum foam was found in both the field tests and the pendulum experiments. The experimental results and the numerical simulations reveal the behavior of the RC plates under different loads.

KEYWORDS

Impact, Pendulum, HE Field Test, Aluminum Foam.