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THE BGU PROTECTIVE TECHNOLOGIES RESEARCH AND DEVELOPMENT CENTER - RESEARCH CAPABILITIES AND METHODOLOGY

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The need to improve the design of military structures in order to withstand short duration extremely high dynamic loads and the need to develop means for mitigating blast wave loads have become clear in light of recent terrorists' attacks on facilities throughout the world.

As a consequence the Protective Technologies Research and Development Center has been established in the Department of Mechanical Engineering of the Faculty of Engineering Sciences of the Ben-Gurion University.

The main goals of the research center are to better understand the following phenomena:

1. The propagation of shock and blast waves in granular media.
2. The propagation of shock and blast waves inside complex structures.
3. The propagation of shock and blast waves in complex channels.
4. The interaction of shock and blast waves with complex structures.
5. The dynamic response of structures to shock and blast wave loads.
6. The mitigation of shock and blast wave loads by material means.
7. The mitigation of shock and blast wave loads by geometrical means.
8. Behavior of absorbing energy structures and material under blast loads.

In order to study the response of a structure to a blast wave load one has to characterize the dynamic load of the blast wave, and the response of the construction materials to the short duration dynamic load.

The methodology of the research in the Center is based on the forgoing presentation is as follows:

Characterization of the load: Shock tubes and explosive wire chambers are used to investigate the propagation and interaction of shock and blast waves with small-scale structures. The obtained experimental data are used to calibrate numerical models that are developed in order to simulate the investigated phenomena. The developed and calibrated numerical models are then validated by full-scale field experiments.

Characterization of the material and structural response: an impact pendulum and some accompanying facilities are used to investigate the behavior of structures and materials under short duration loads. The results are used to calibrate numerical models that are developed in order to predict the structure behavior. The developed and calibrated numerical models are then validated by full-scale field experiments.



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The results of the shock wave propagation model will be integrated in the structural model, and both will give the ability to predict the response of structures to blast wave loads.

In order to achieve the just mentioned long-term goals, four main laboratories were established at the Protective Technologies Research and Development Center.

1. A shock tube laboratory
2. An explosive wire chambers laboratory
3. An impact pendulum laboratory
4. A light gas guns laboratory

The numerical models, which are developed, are based on the following numerical codes:

1. Abaqus
2. Ansys
3. LS-Dyna
4. MSC/Dytran
5. In house codes

The capabilities of the above mentioned experimental facilities will be presented in details.

In addition, experimental and numerical results of few of the problems, which have already been investigated in the Protective Technologies Research and Development Center, and our first results from a recent field test will be presented.