IMPACT OF SHOCK WAVES FROM HE-DETONATION ON REINFORCED CONCRETE STRUCTURES – NUMERICAL AND FIELD STUDIES

A. Agasty, M. Nolde, S. Schwarz, G. Hüsken

BAM - Federal Institute for Materials Research and Testing, 2.3 - Explosives
Unter den Eichen 87, 12205 Berlin, Germany

Key words : Shock-Structure-Interaction, Numerical Simulations, Field Tests, Piezoelectric Pressure-Gauge

An effective protection of structures against impact from detonation of high explosives (HE) necessitate certain design specifications to be met. In the event of an explosion, accidental or intentional, any damage in its neighborhood (especially, for example, to the structures of strategic importance) should remain as low as possible. The behavior of a structure under the shock loading from an explosion will determine the extent of the damage. The investigation of the relevant phenomena that occur during the event of an explosion is the objective of this study.

A series of field trials were carried out at the BAM test range in Brandenburg (Germany) to study the impact of HE detonation on reinforced concrete structures. The field tests involved the detonation of HE in front of two 30 cm reinforced concrete walls. One concrete wall was protected by a 2 cm thick steel plate, whereas the second wall was tested without. Both plates were cast with identical concrete mixes and same reinforcement ratio. The shock impact on the walls was interpreted based on the readings from four strain gauges, which were placed on the reinforcement inside the structure at known positions.

In accordance with the test parameters, numerical simulations were performed and results were compared with those from field tests. The deformation of the wall under shock impact was simulated by implementing the appropriate interaction of fluid and structure. Moreover, the numerical pressure-time histories in front of the wall were compared with the ones measured in the field by means of piezoelectric pressure gauges, providing a validation for the shock waves' propagation.