

EXPERIMENTAL STUDY ON POLYUREA-COATED RC SLAB SUBJECTED TO CONTACT EXPLOSIONS

*Minghsien Wu¹, Yingkuan Tsai¹, Chien-Hsien Liu¹, Pang-Ting Pai¹, Feng-Cheng Yang¹, Chun-Chia Huang¹

1. Chung Cheng Institute of Technology National Defense University

Global terrorism is on the rise as the number of attacks soared, puts the world under the threat of car bomb, suicide bomb and so forth, and causes a huge amount of loss of life and property. Current buildings and infrastructures are mostly constructed using reinforced concrete, due to the brittleness of concrete material, when a structure subjected to blast loadings, the phenomena such as cracking and spalling at the proximal face of the target, and the ejection of fragments from the distal face of the loaded surface can be observed. These types of damage or failure could severely harm to the structural stability and the safety of people and equipment inside the building. Thus, the blast resistance of buildings has become an important issue in structural design and evaluation. Considering the high tensile strength and excellent impact resistance of polyurea materials, it is expected that the blast performance of a reinforced concrete element can be enhanced by coating this material onto its surface.

The purpose of this study is to investigate the blast performance of the polyurea coating on reinforced concrete slabs by conducting a series of filed explosion tests. The size of the specimen is 50cm×50cm×15cm. Four pieces of RC slabs were tested: RC slab without coating, RC slabs with coating on the front face, coating on the back face, and coating on the both faces. The thickness of coating is 3 mm. The specimens were fixed on a steel frame and detonated at the center of the test surface with a size of 5cm×5cm×2.5cm of 100g C4 rectangular explosive. The size and depth of the damage area on the front and back of the RC slabs were measured and evaluated by developing 3D models with point clouds from photographs.

The results show that when the unreinforced RC slabs is subjected to contact explosion, cratering will occur on the front side of the specimen and spalling will occur on the back side of the specimen; and when the RC slabs is coated on the front side of the specimen, the polyurea reinforcing layer at the contact explosion site is destroyed, but the damage degree were reduced; and in the case of the back-explosive surface reinforcement, the damage range of the cratering is also reduced, and the polyurea coated with the back-explosive surface has no crack, damage and blow-through. When the coating layer is removed, the back surface of the test piece is observed, and only cracks are generated but no obvious spalling. It is obvious that polyurea produces good adhesion due to its material properties and tightly constrains the fragments. Therefore, it has been shown by experiments that the use of polyurea elastic coatings to reinforce the explosion surface or the back explosion surface of the RC slabs can enhance the explosion-proof capability and reduce or protect from spalling, thereby achieving the purpose of protecting the internal life and property of the building. It is known from this test that the polyurea coating with a thickness of 3 mm can effectively and significantly reduce or avoid the occurrence of spalling when applied to the back surface of RC slabs.

Keywords: polyurea coatings, contact explosions, cratering, spalling