

Abstract

Resistance of structures to blast loads is an important consideration in the design of modern superstructures, especially in large metropolises with iconic buildings. The threat of terrorist attacks, particularly in the form of Improvised Explosive Devices (IEDs), has been increasing. The high-intensity loads generated from an explosion can have significant detrimental effects on structures that are not designed to resist blast loads. In particular, significant casualties may result if no protection is provided to mitigate blast effects.

An ultra-thin steel fiber reinforced concrete panel that is also reinforced by steel welded wire fabric is proposed as a cost competitive, architecturally malleable alternative to protect the building envelope and the building occupants from a blast. It is expected that this non-structural exterior wall cladding panel will resist blast loads through large deformations and dissipation of stresses. Specifically, the steel fibers and reinforcing wire fabric will significantly increase the plastic deformation capacity of the panel via membrane action. It will also substantially decrease the amount of cracking and spalling of concrete through mechanical bonding. These are crucial benefits because spalled pieces of concrete are prevented from becoming harmful projectiles.

The results of this thesis show that a steel fiber and welded wire fabric reinforced concrete panel is an effective solution for providing blast protection. Reinforcement using steel fibers significantly increases the ductility and deformation capacity of the concrete panel. Despite large deformations, steel fiber reinforcement also severely limited cracking and spalling of the concrete.