ABSTRACT

Reinforced concrete has been widely used over many years by civil and military engineers in the design of protective structures to resist impact and explosive loads due to its generally high stiffness, weight, and favorable cost to strength ratio. An impact or explosive load are loads of extremely short duration that can be manmade, such as bombing and attacks, or it can be natural disasters such as hurricanes and volcanoes. In the event of an impact or explosive loading at a high risk facility, it is crucial for concrete structures to be protected and reinforced with a system that is ductile enough to provide strength and flexibility to improve the response mode of the structure.

This thesis proposes to test a new steel reinforcement system in concrete in the form of a steel wire mesh cage, as a protective surface to the concrete and also to induce membrane behavior in a concrete structure. By transferring the loads throughout the concrete using finely spaced wires, the concrete will develop less scabbing (propagation of cracks) and spalling (ejection of concrete projectiles). In addition to a mesh reinforcement system, this paper also studies the implication of high strength concrete in resisting blast loading, including self-consolidating concrete.

The results of this study show that by using the wire mesh cage reinforcement, the reinforced concrete section is more ductile and produces less scabbing along the surface. Both characteristics imply improved response factors to impact loading without compromising the control of static properties.