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Investigation the effects of reinforcement bars in Blast resistance behavior of a R.C wall

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Abstract

Concrete is widely used in design of protective structures due to its good energy absorbing characteristics under high pressures and, when properly reinforced, ductile behavior. Nevertheless, the response of concrete structures subjected to severe dynamic loading differs from their static behavior, on a structural level but also on a material level. In this paper the overview of the blast phenomenon and the effects of explosion on structures would be presented and then the AUTODYN software with Lagrangian solver coupled with Eulerian solver were used in the numerical simulations for evaluating the response of a concrete wall structure under blast loadings. Analyzing this structure with different reinforcement patterns was done to investigate the effects of ductile detailing on blast resistant behavior of the reinforced concrete wall. Numerical simulations shows that, models with higher percentage of reinforcement and ductile detailing have a better energy absorption capacity under blast loading and therefore have higher blast resistance capacity compare to other structure.

Keywords: Blast loading, R.C wall, Ductile detailing, Dynamic behavior.

1. EXPLOSIONS AND BLAST PHENOMENON

An explosion is defined as a large-scale, rapid and sudden release of energy. Explosions can be categorized on the basis of their nature as physical, nuclear or chemical events. Explosive materials can be classified on the basis of their sensitivity to ignition as secondary or primary explosive. The latter is one that can be easily detonated by simple ignition from a spark, flame or impact. Materials such as mercury fulminate and lead azide are primary explosives. Secondary explosives when detonated create blast (shock) waves which can result in widespread damage to the surroundings. Examples include trinitrotoluene (TNT) and ANFO.

The detonation of a condensed high explosive generates hot gases under pressure up to 300 kilo bar and a temperature of about 3000-4000C°. The hot gas expands forcing out the volume it occupies. As a consequence, a layer of compressed air (blast wave) forms in front of this gas volume containing most of the energy released by the explosion. Blast wave instantaneously increases to a value of pressure above the ambient atmospheric pressure. This is referred to as the side-on overpressure that decays as the shock wave expands outward from the explosion source. After a short time, the pressure behind the front may drop below the ambient pressure (Figure 1). During such a negative phase, a partial vacuum is created and air is sucked in. This is also accompanied by high suction winds that carry the debris for long distances away from the explosion source; [1].

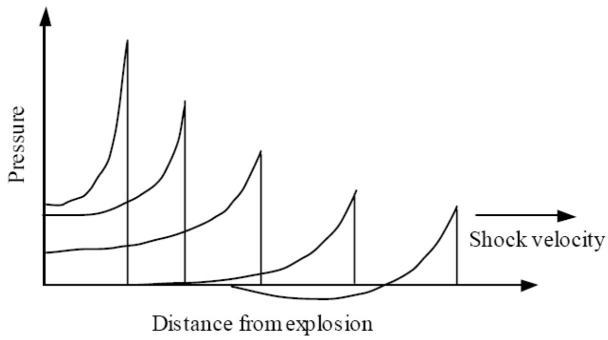

Figure 1. Blast wave propagation