PERFORMANCE OF STEEL-CONCRETE COMPOSITE SLABS AGAINST HIGH VELOCITY IMPACT

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Abstract: The development of missiles of higher penetration capacity requires concrete protective structures of better performance against high velocity impact. Conventionally, normal strength concrete (NSC) has been used in protective structures and recently ultra-high performance fiber reinforced concrete (UHPFRC) is being explored for application. However, RC slabs of conventional detailing may not be sufficient to meet target performance objective within practical dimensions. The formation of shear plug during projectile penetration is a prominent mode of failure in large velocity projectile impact to RC slabs. The introduction of steel plate at the rear surface can delay the formation of shear plug and improve the penetration resistance of RC slabs.

This paper investigates the performance of steel-concrete composite slabs (SCCS) with steel liner at the rear surface of the slab through experimental tests and numerical studies. Two types of composite slabs have been used (Figure 1): i) steel liner with U-hooks, and ii) steel liner with shear studs. The depth of penetration, damage area and failure patterns of concrete slabs against high-velocity are investigated and quantified using a ballistic gun setup. The finite element (FE) model of the experimental setup was developed in LS-DYNA. Numerical simulations were conducted to further study the failure evolution during the impact. The damaged SCCS slabs were subjected to shock loading to check the residual capacity of the specimen in case of explosion. The efficacy of the steel liner in improving the impact performance of SCCS was studied and compared to plain and RC slabs without steel liner.

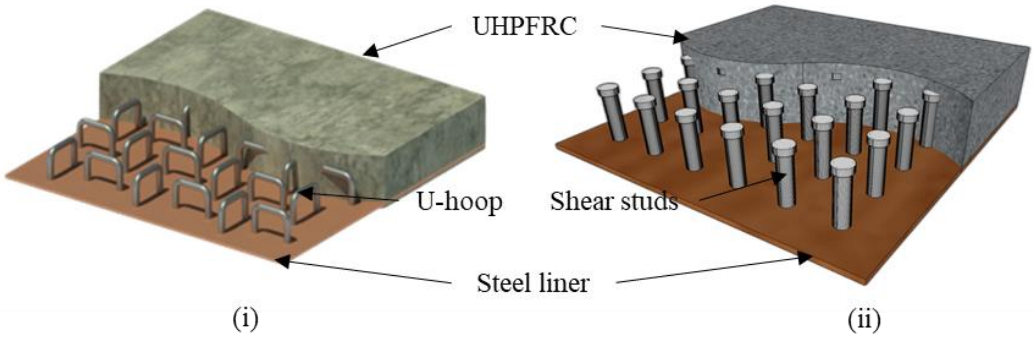

Figure 1: Steel concrete composite slab with i) U-hooks, and ii) shear studs