Synopsis

Thesis Title : Investigations on Blast Performance of Laced Steel-Concrete Composite Slabs

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Sudden release of energy due to explosion in air generates shock waves. Instantaneous increase of pressure over and above atmospheric pressure occurs as this shock wave arrives at a point. Structures located on the way of propagation of shock waves are loaded with reflected pressure, which is much higher than the incident pressure. Under blast loading, structural elements are expected to undergo large inelastic deformation, which demands for large ductility. Even though, reinforced concrete, the most widely used construction material, possesses excellent fire-resistance characteristics and can absorb large amount of energy, if provided with proper detailing, due to blast loading weakens the core and affects the integrity of the structure. Among the alternative systems of construction, Laced Steel-concrete Composite (LSCC) construction, which combines the advantages of LRC and SCC, is found to possess large support rotation and structural integrity.

Only preliminary studies to understand behaviour of LSCC beams under monotonic and reversed cyclic loading have been carried out. Blast resistant design of structures has become increasing important in present day scenario. There are many occasions where such loading gains importance such as in chemical industry, explosive storage units for defense installations etc. In such structures, slabs forms basic component. Basic unit such as LSCC beam is not suffice. Therefore, an integrated unit of LSCC beams to slab will be utmost usage. Moreover, LSCC being a new system requires detailed investigation before field application. In this present investigation, behavior of LSCC slabs under blast loading is proposed to be studied. Integration scheme for LSCC slab has been proposed and numerical studies indicate that proposed integration scheme for one way LSCC slab is found to effective. Series of analytical solutions to predict the load-displacement behaviour, flexural and shear resistances of LSCC beam/one way slab is developed. Parametric studies are conducted to determine the influence of different parameters on the response of LSCC slabs under blast loading. Studies lead to the conclusion that plate thickness significantly affects the response than the cross rod diameter and lacing diameter for same grade of concrete.