IMPULSIVE LOADING ON REINFORCED CONCRETE SLABS

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SUMMARY

Reinforced concrete slabs were exposed to blast and impact loading in order to access modes of slab behaviour under these extreme dynamic loadings.

Two sizes of specimens were used and smaller slabs modelled the large slabs at 1: 2.5 scale.

Impact loads were produced by free falling hammer impacting coaxially onto a cylindrical bar of steel placed at rest in the centre of the slab. The steel bar was instrumented with electrical strain gauges which recorded the stress pulses produced by the impact.

Blast loads were produced by explosive charges made of Plastic Explosive PE4. In most cases the charge had the hemispherical shape and was placed centrally above the slab at close range standoffs i.e. up to 10 times the radius of the charge.

Additional blast tests were conducted in order to monitor the transient and spatial pressure distribution across the slab by using the pressure gauges placed in replica steel slab.

Transient deflections of the slabs under both types of load were obtained using long stroke displacement transducers, while transient strains in the steel reinforcement of the slabs were obtained using electrical resistance strain gauges bonded to the steel bars at mid span point.

A rotating prism high speed camera was used to film the damage on some of the small scale specimens at rates of up to 10,000 pictures per second.

The Hopkinson pressure bar tests were used to obtain dynamic characteristics of concretes of both scales at high rates of loading.

An analytical function of the spatial and transient blast pressure distribution based on detonation pressure of PE4 was established and is in close agreement to experimentally measured results.

The nature of the local and overall failure were discussed and time sequence of slab failure established for the case of explosive loading.

A crack pattern that occurs soon after the explosion in area of local failure has been established from the high speed films while the overall deflected shape was obtained from the displacement vs time records.

After test scab sizes and slab perforations were used to establish a relation between the slab thickness, amount of explosive and the slab damage in respect to scabbing and perforation.

The displacement records and the shape of after test damage provided the bases for comments on "gravity neglected - ultimate strength modelling law that was employed in this research.