EXPERIMENTAL AND MODELLING ASSESSMENT OF CONCRETE STRUCTURES USING BLAST SIMULATOR WITH APPLICATION TO NUCLEAR CONTAINMENT

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Abstract: Breaches of concrete containment walls as a result of blast loadings poses a significant risk to the operation of many defence and nuclear facilities. The treatment of said structures differs from other reinforced concrete (RC) structures used in civil construction and is governed by more stringent criteria. A preliminary survey identified a limited number of studies aimed at assessing said response of containment vessels to blast loadings. Furthermore, current regulatory guides and standards employ outdated empirical formulas calibrated with data no longer suited to the assessment of modern RC structures in nuclear facilities. The experimental tests conducted herein utilised the National Facility for Physical Blast Simulation (NFPBS) (Figure 1) to carry out blast simulation on traditional RC, of variable strength, alongside fibre-reinforced concrete to gauge their respective responses to a shock overpressure of 250kPa. Measurements were recorded for the blast overpressures and *in situ* dynamic displacement of the back face of the slabs. Post failure analysis of the slab were also conducted to qualitatively assess the crack and failure behaviour of the various designs. The experimental results were used to calibrate a number of finite element models using the LS-DYNA code to develop a predictive framework of threat response.

Figure 1. View of damaged RC panels after testing in the blast simulator.