



Numerical Derivation of Pressure-impulse Diagrams for a Fixed-end RC Beam Subjected to Blast Loads

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Abstract

This paper presents numerically derived Pressure Impulse (P-I) diagrams for a fixed end reinforced concrete (RC) beam subjected to blast loads. To capture the nonlinearities associated with the load deflection (resistance) function of the beam, a numerical approach was used to derive these diagrams. Several dynamic analyses were conducted to generate the P-I combinations resulting in an identical response limit (iso-damage). The first set of analyses was performed using a three dimensional finite element model implemented using general purpose software ABAQUS. Another set of analyses was conducted using a single degree of freedom (SDOF) elastic perfectly plastic idealization of the beam. These diagrams were generated for two response limits corresponding to the adequacy of flexural action being maintained in the beam. Results show good agreement between the P-I diagrams derived using the two distinct sets of analyses in the quasi-static loading regime. However, the diagrams deviate significantly in the dynamic and impulsive loading regimes based on the type of modeling approach used. Furthermore, stiffness degradation contours from finite element simulations reveal that shear dominant modes of failure can occur prior to the deflection limit being attained in the RC beam.

Keywords: RC beams, Blast loads, P-I diagrams, Damage pattern