COMPUTATIONAL ANALYSIS OF PENETRATION INTO CONCRETE

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A series of experiments was performed to analyze the response of a penetrator impacting two different concretes. Finite element (FE) analyses were then performed to reproduce the results, exercise the capabilities of the FE code, and determine the effects of some parameters on the depth of penetration. The first principles code EPIC was used to perform all the simulations presented in this study. The high velocity normal impacts of a steel ogival nose penetrator and the subsequent penetration to some depth in the concrete were explicitly modeled using tetrahedral finite elements. These conditions allowed the simulations to be performed using a two-dimensional axisymmetric configuration. Two concretes of different strengths were modeled using a Holmquist-Johnson-Cook crushable/concrete constitutive model. The low strength concrete had a nominal compressive strength of 23.0 MPa, while the higher strength concrete's was 38.7 MPa. Material parameters were fit to a series of material tests performed on small concrete specimens. Element deletion was enabled to allow penetration, and the impact velocity prescribed an as initial velocity to the penetrator. Good correlation was found for the penetration depths and acceleration time histories between the EPIC simulations and the experimental results.