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A Comparison of Three Empirical Methods for Concrete Penetration Depth by a High Speed Ogive Shaped Projectile

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Abstract: This paper compares experimental data to three empirical models for determining the depth of penetration into concrete for a hard ogive shaped projectile fired at high speed normal to the surface of the concrete. The three empirical models are the Modified National Defense Research Council Formulas, the Haldar-Hamieh Formulas, and the Sandia Formulas. These empirical methods are compared to six experimental test cases published in three separate articles for concrete with an unconstrained compressive strength ranging from 34.6 MPa to 62.8 MPa shot with different sized and shaped light-weight projectiles. The results show that the Sandia Formulas predicted the concrete penetration depth closest to the observed depth, but only for impact velocities less than 800 meters per second.

Keywords: Concrete Penetration, Projectile, Impact Engineering