

WIND-BORNE MISSILE IMPACT OF REINFORCED CONCRETE PANELS

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ABSTRACT

United States Nuclear Regulatory Commission Regulatory Guide 1.76, Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants, identifies a set of missiles and impact velocities to be considered in the design of nuclear power plants. Empirical formulae have been used to calculate local and global responses of reinforced concrete walls and slabs impacted by tornado- and hurricane-borne missiles, where these formulae have been calibrated using a small set of test data. Terranova et al. [1] concluded that the empirical formulae do not inspire the level of confidence expected for the analysis of a nuclear structure. The shortcomings with the predictive equations, and a lack of knowledge regarding those parameters that most affect impact resistance against soft and hard missiles, prompted the authors to validate a numerical tool for impact analysis of reinforced concrete panels using data from tests performed by EPRI and Calspan in the 1970s. The Smooth Particle Hydrodynamic (SPH) formulation is used to predict penetration, scabbing and perforation. Limitations on the use of this method are identified. A preliminary numerical investigation of parameters not considered in the experiments that affect impact resistance of reinforced concrete panels is introduced.