NORMAL STRENGTH AND ULTRA-HIGH PERFORMANCE CONCRETE BEAMS UNDER IMPACT

T. Krauthammer[1], D. Koch[1], M. Stone[1], S. Astarlioglu[1], and Lewis, R. Lewis[2]

[1] Center for Infrastructure Protection and Physical Security, University of Florida, Gainesville, FL 32611-6580, USA; [2] Defense Threat reduction Agency, Ft. Belvoir, VA 22060-6201, USA

Key words: NSC, UHPC, beams, impact

Concrete is one of the most widely utilized building materials because of its cost, and wide range of applicability. Ultra high performance concrete (UHPC) is a reactive powder concrete that is combined with admixtures and steel fibers to produce a denser, stronger and more durable material than normal strength concrete (NSC). UHPC has superb material characteristics with compressive strengths generally exceeding 150 MPa and tensile strengths reaching up to 20 MPa. Consequently, UHPC has been shown to be far more resilient to dynamic loading than normal strength concrete. A variety of UHPC mixes have been developed by the commercial and private sectors to fit specific needs. Researchers at the U.S. Army Engineer Research and Development Center (ERDC) developed a UHPC mix entitled Cor-Tuf in two variations, with and without fibers. This study is dedicated to dynamically test full scale UHPC beams and also focuses on the effects of strain rate on Cor-Tuf. The data obtained from these test will be utilized to calibrate finite element models created with the computer code ABAQUS, as well as the Dynamic Structural Analysis Suite (DSAS) developed at CIPPS to predict the results. The predicted data were used to design a series of NSC and UHPC beams that were tested statically and under impact to study their physical behavior, and to define the effect of the materials on the observed performance.

This paper will describe the study, present both numerical and test results, and provide conclusions and recommendations.