VANDERBILT
School *of* Engineering

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

Friday,

Feb. 21, 2025

12:15 pm

FGH 136

"SCALED PHYSICAL MODELING OF SOIL-FILLED BARRIERS SUBJECTED TO BLAST UTILIZING THE U.S. ARMY GEOTECHNICAL CENTRIFUGE"

DR. CATHERINE STEPHENS

RESEARCH CIVIL ENGINEER
U.S. ARMY ENGINEER RESEARCH
& DEVELOPMENT CENTER

ABSTRACT

Soil-filled barriers are often used as perimeter security in the initial stages of military contingency construction. One purpose of the barriers is to provide standoff enforcement for blast events. As standoff enforcement, soil-filled barriers can be subjected to blast, but their breach behavior is not well understood. A need exists to rapidly assess the breaching of barriers in close proximity to a blast event. For time and cost savings, high-performance computational modeling was used to investigate the breach behavior of soil-filled barriers due to blast; however, existing experimental data to support the computational modeling was not sufficient. The use of scaled centrifuge testing was investigated to generate a robust experimental data set. The objectives of this study were to: (i) develop a scaled testing method for determining the breach behavior of soil-filled barriers due to blast and (ii) validate the scaled testing method using full-scale experimental data. The U.S. Army centrifuge was used for scaled experiments studying different barrier configurations and failure modes to compare the breach behavior of the scaled model to full-scale experiments. It was found that the centrifuge models' breach behavior closely matched the full-scale experimental data for the configurations and failure modes examined. The scaled testing method was determined to be a valid method for determining the breach behavior of soil-filled barriers due to blast.

BIOGRAPHY

Dr. Stephens is currently serving as a technical lead for the $8.5M/year Army funded project Expedient Passive Protection. Dr. Stephens is a subject matter expert in the areas of force protection, perimeter security, protective structures, materials characterization, weapons' effects on structures, blast and ballistic threat mitigation, advanced material applications in protective construction, and reach-back for support to forward deployed forces. Dr. Stephens joined the U.S. Army Engineer Research and Development Center in March of 2013. She served as the Director of the ERDC International Research Office from June 2021 to July 2024. She served as the ERDC liaison to Headquarters, Army Futures Command from July 2020 to January 2021. Dr. Stephens completed her Doctor of Philosophy in Civil Engineering at Vanderbilt University in 2013. Dr. Stephens also completed a Master's degree from Vanderbilt University in Civil Engineering in 2010 and a Bachelor's degree from Western Kentucky University in Civil Engineering in 2008.