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PRECAST/PRESTRESSED CONCRETE EXPERIMENTS PERFORMANCE ON NON-LOAD BEARING SANDWICH WALL PANELS

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To comply with the energy efficiency and build green initiatives contained in the Energy Policy Act of 2005 and Energy Independence Security Act of 2007, the Anti-Terrorism and Force Protection (ATFP) requirements for building construction, and the "build-it faster and more economical" requirements of the Military Construction Transformation initiative, a research program has been conducted by AFRL and the Portland Cement Association (PCA) on the performance of insulated concrete wall panels. The purpose of the research is to determine if commercially available wall systems with excellent energy savings performance can provide ATFP for military and government facilities. This report presents the static performance of the wall systems subjected to pseudo-blast pressures. The results indicate that sandwich wall systems provide blast resistance over a large deformation range making these systems useful for ATFP applications. The responses of the panels were found to be sensitive to reinforcement type, shear ties used, and insulation.

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1. INTRODUCTION

To comply with the energy efficiency and build green initiatives contained in the Energy Policy Act of 2005 and Energy Independence Security Act of 2007, the Anti-Terrorism and Force Protection (ATFP) requirements for building construction, and the “build it faster and more economical” requirements of the Military Construction Transformation initiative, a research program has been conducted by the Air Force Research Laboratory (AFRL) and the Portland Cement Association (PCA) on the performance of insulated concrete wall panels. The purpose of the research is to determine if commercially available wall systems with excellent energy savings performance can provide ATFP for military and government facilities.

The use of insulated precast/prestressed (PC/PS) concrete and insulated tilt-up concrete sandwich panels for exterior walls is common practice in the United States. These forms of construction provide a thermally efficient and high-mass wall that enhances the energy efficiency and blast resistance of the building making it ideal for military and government facilities. In most cases these building systems must be designed against a potential explosive demand. Current design recommendations are very restrictive when using these forms of construction, due in large part to the lack of experimental research data. To address this issue a research program has been conducted to assess the performance of conventional insulated exterior wall systems under blast loading. This report presents the static performance of the wall systems subjected to pseudo-blast pressures. The results indicate that sandwich wall systems provide blast resistance over a large deformation range making these systems useful for ATFP applications. The responses of the panels were found to be sensitive to reinforcement type, shear ties used, and insulation. Detailed discussions of the findings are presented in the conclusions of the report.

The information presented in this report represents the second phase of work under a Cooperative Research and Development Agreement (CRADA) entitled Blast Resistant Concrete Products. The CRADA is between PCA and the Airbase Technology Division of AFRL at Tyndall Air Force Base, Florida. Fabrication, design support, and product donations have also been provided from the Precast/Prestressed Concrete Institute (PCI), the Tilt-Up Concrete Association (TCA), and their member companies. Experiments were conducted and supervised by AFRL staff. National Center for Explosion Resistant Design at the University of Missouri-Columbia performed the static series discussed in this report.