

Ultra-High Performance Concrete (UHPC)

Overview

The U.S. Department of Homeland Security (DHS) Science and Technology (S&T) Directorate's Infrastructure Protection and Disaster Management Division (IDD) is currently working on developing a UHPC material that will be affordable and competitive in the U.S. market. The main objective of this project is to provide a material that exhibits high performance standards and can be easily used when an all hazard/integrated approach is required. It should meet performance requirements for explosives and other natural hazards such as earthquakes, floods, winds, and fire. The benefits of this product includes durability, less reinforcement requirements, and low project maintenance. This project is being implemented with the collaboration of Engineer Research and Development Center (ERDC), universities, and national labs, which include Georgia Institute of Technology, Massachusetts Institute of Technology, University of Connecticut, Oak Ridge National Laboratory, and Sandia National Laboratory. This effort will be significant in the protection of our critical infrastructure.

Challenges

This program aims to identify the most effective methods of promoting the construction and commercialization of affordable, available, and reliable UHPC materials in the U.S. construction market. The cost advantages to the user community will be increased performance in ultra-high strength; ductility; flexibility and toughness, impact resistance; dimensional stability; ability to construct thin sections and complex structural forms, durability—increased usage life; impermeability—freeze/thaw resistance; corrosion resistance; fire resistance; abrasion resistance; and aggressive environment and chemical resistance.

The main challenge of this project is to eliminate the barriers that are an impediment for the commercialization of UHPC. One challenge of this effort is to produce UHPC product in large quantities to become competitive in U.S. markets. Another challenge is to identify performance standards acceptable to the industry. In addition, issues such as quality control in manufacturing facilities and definition of UHPC testing methods need to be addressed.

Users

U.S. Design and Construction Industry; American Concrete Institute; Portland Cement; DHS Infrastructure Protection; Federal Emergency Management Agency; Commercial and Government Facilities; State and local governments; Code Officials; Associations of Engineers and Architects.



UHPC Roadmap

On January 11-12, 2011, DHS S&T IDD in collaboration with the University of Connecticut and Columbia University, held an international workshop on UHPC to identify impediments restricting UHPC acceptance and usage in the U.S., and to outline research needed to bring UHPC into the mainstream of U.S. construction. The roadmap addresses the following issues: a) current worldwide construction usage of and experience with UHPC; b) types of construction and uses for UHPC and benefits to society; c) acceptance by civilians, governments, engineers, and architects and use by construction industry personnel; d) cost and liability issues; e) status of general industry facilities and capabilities required to produce and construct with these materials; f) building code requirements including material and prototype testing; g) quality control and assurance, maintenance, and inspection requirements; h) construction practices and performance verification procedures; and i) aspects of basic and application research required to ensure performance.



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