Beneficial Use Case Study

Global Change Institute Building

Coal Combustion Product Type:
Fly ash

Project Location:
Brisbane, Australia

Project Participants:
Wagners, University of Queensland, Hassell Group, Bligh Tanner, Arup, Medland Metropolis, Precast Concrete Pty. Ltd., McNab Builders

Project Completion Date:
2013

Project Summary:
Established in 2010, the Global Change Institute's (GCI) mission is to address the impacts of climate change and population growth through collaborative research in areas such as clean energy, food systems, and healthy oceans. When the Institute's headquarters was being designed, sustainable building principles were employed to serve as an outward reflection of the organization's objectives. To that end, among the construction materials specified was geopolymer concrete incorporating recycled fly ash and granulated blast furnace slag (GBFS).

Project Description:
Intended as a showcase of the "next generation of environmental building technologies," the Global Change Institute headquarters is a four-story building comprising three suspended concrete floors made from 33 precast geopolymer concrete panels. Toowoomba-based construction materials company Wagners supplied 330 cubic meters of Earth Friendly Concrete (EFC) for the large floor beams that form the floor plates.

EFC is a proprietary blend of fly ash and GBFS that uses no portland cement. Wagners supplied 110,550 metric tons of the slag and fly ash—the latter sourced from the Millmerran power station, a nearby plant fueled by bituminous coal. The fly ash complies with AS/NZS 3582.1: 2016, which is similar to the ASTM C618 Class F standard used in the U.S. Batched at the Toowoomba EFC plant, each beam required the delivery of two truckloads of EFC to the precast facility in Carole Park, Brisbane. Chemical activation was carried out at the precast yard when the trucks arrived to eliminate the risk of holds-ups on the busy highway between those two locations.

According to Wagners, use of EFC boasts a number of environmental and performance advantages over portland cement concrete, including:

- Emissions reductions of 80-90%
- 30% higher flexural strength
- High sulfate, acid, and chloride ion ingress resistance
- Low shrinkage
- Low heat of hydration

Use of EFC in the construction of the Global Change Institute represented the first-ever application of geopolymer concrete in the structure of a multi-story building; the only prior use was in test batches used for sidewalks. The EFC beams also play a significant role in low-energy space heating, with the placement of water pipes inside them to achieve temperature-controlled hydronic heating of the building spaces above and beneath.

Designed to function as a zero-energy and zero-carbon workplace, the Institute has earned a Green Building Council of Australia 6 Star Green Star Design rating and received numerous awards, including being named the 2013 BPN Sustainability Awards winner for innovation of the year.

SOURCE: Wagners.

SOURCE: Wagners.