Slag Cement Association 2016 Project of the Year Awards

The Slag Cement Association (SCA) presented the Slag Cement 2016 Project of the Year Awards on March 28, 2017, during the meeting of ACI Committee 233, Ground Slag in Concrete, at The ACI Concrete Convention and Exposition – Spring 2017 in Detroit, MI. The awards recognize projects for excellence and innovation in concrete using slag cement. Eight projects were honored in the categories of Architectural Design, Durability, Green Design, High Performance, Sustainability, and a new category, Innovative Applications.

Sustainability

St. Pete-Clearwater International Airport, Clearwater, FL

The airport expansion called for the rehabilitation of 16,000 yd^3 (12,000 m^3) of apron pavement. The project included removal of asphalt and portland cement concrete pavement sections near airport Gates 1-11 and associated baggage areas. The project was completed in five phases spanning 9 months during the airport's peak season—all while airport activities continued.

The new pavement comprised a heavy-duty, 650 psi (4.5 MPa) flexural strength concrete mixture that included slag cement. The mixture's superior strength gain allowed the project to be executed without interrupting airport services. The mixture's slag cement resulted in pavement with high reflectivity, adding to the visibility at the tarmac.

Project Credits: St. Pete-Clearwater International Airport, Owner; AVCON, Inc., Engineer; GLF Construction Corporation, Contractor; and Argos USA LLC, Concrete and Slag Cement.

Design

University of Notre Dame Campus Crossroads Project, Notre Dame, IN

The University of Notre Dame Campus Crossroads Project was the largest construction venture undertaken at the University since its opening in 1842. The $400 million, LEED Silver project consisted of attaching three new buildings onto the existing football stadium, increasing the stadium's capacity by 750,000 ft^2 (70,000 m^2).

The total project entailed 58,000 yd^3 (44,000 m^3) of concrete, with over 13,000 yd^3 (1000 m^3) of mass concrete foundation elements. For mass concrete placements, a concrete mixture with 70% slag cement was used to control the temperature rise and maintain the core temperature below the specified maximum of 158°F (70°C). Thermocouples installed in the foundation elements showed that none of the placements exceeded 130°F (54°C), even though over 1000 yd^3 (760 m^3) was required. Although many mass concrete placements were completed when ambient temperatures were below 10°F (−12°C), the maximum differential between the core and extremity of each member was kept below the specified

St. Pete-Clearwater International Airport

University of Notre Dame Campus Crossroads Project

I-275 reconstruction

Ten Hudson Yards

maximum differential of 35°F (2°C). The mass concrete mixtures also typically reached 28-day design strengths in 7 days.

Project Credits: University of Notre Dame, Owner; S/L/A/M Collaborative, Architect; Structural Design, Inc., Engineer; Barton Malow Company, Contractor; Ozinga Ready Mix Concrete, Inc., Indiana Division, Concrete; and LafargeHolcim, Slag Cement.

Durability

Revive 275: I-275 Improvements through Oakland and Wayne Counties, MI

The Michigan Department of Transportation (MDOT) spent $75 million to replace 88 lane miles (142 km) of pavement on I-275 through Wayne and Oakland Counties, MI. This stretch of freeway is the busiest in Michigan. It was reconstructed and paved 15 years ago, but that pavement did not include slag cement—it failed due to alkali-silica reaction (ASR) and a poor air void system. MDOT specified 30% slag cement replacement because the mixture would have improved ASR-mitigating properties and provide a more robust environment for the development of air entrainment. Toebe Construction used LafargeHolcim MaxCem, a Type IS (30), ASTM C595/C595M blended cement to meet the logistics of this fast-tracked project (MDOT instituted a $150,000/day penalty if the freeway was not open September 1, 2016). Toebe likes slag cement for its rheological properties, appreciates its added creaminess, and its ability to hold a slipformed edge.

The project's blended cement was produced at the LafargeHolcim terminal in Detroit, MI. The terminal stores individual cements and cementitious products, blends them on demand, and discharges them into the customer's waiting truck.

Project Credits: MDOT, Owner and Engineer; Toebe Construction, LLC, Contractor and Concrete; and LafargeHolcim, Slag Cement.

High Performance

Ten Hudson Yards, New York City, NY

Ten Hudson Yards is one of the first concrete office buildings in New York City, NY. This 50-story, 895 ft (273 m) tall project consists of 107,000 yd^3 (82,000 m^3) of concrete. This building is the first structure of a 17,000,000 ft^2 (160,0000 m^2) complex on the west side of Manhattan. The complex is being built over an existing railroad yard, which must remain open during construction. Ten Hudson Yards also had to straddle the Highline, a well-used park converted from an old elevated train track that now passes through the lobby of the structure.

The design required high-strength concrete of 14,000 psi (97 MPa) in the foundation and lower shear walls. Slag cement was used to achieve the required strength (mixtures attained over 16,000 psi [110 MPa]) while also minimizing heat gain in mass concrete placements. This project is one of the few post-tensioned buildings in New York City. The structural system comprised high-strength concrete shear walls and post-tensioned beams supporting a filigree (precast concrete topped with cast-in-place concrete) slab system. The 14,000 psi mixture design consisted of 350 lb/yd^3 (208 kg/m^3) of cement, 700 lb/yd^3 (415 kg/m^3) of slag cement, and 50 lb/yd^3 (30 kg/m^3) of silica fume.

To minimize story heights and materials used for the project, the concrete floor structures are exposed concrete, allowing the elimination of hung ceilings. Slag cement contributed to the concrete's consistency and exceptional finish, and so was a major reason for the success of this design approach.

Project Credits: Related Companies and Oxford Properties Group, Owner; Kohn Pederson Fox Associates, Architect; Thornton Tomasetti, Engineer; Tutor Perini, Contractor; Empire Transit, Concrete; and LafargeHolcim, Slag Cement.

Architectural Design

Oceanfront Residence, Southhampton, NY

About 1300 yd^3 (994 m^3) of concrete were used to create this residence's tennis pavilion, underground tunnel to the pavilion, benches, planters, and stairs, as well as the supporting structure. The concrete walls, floors, and ceilings exhibit a wood appearance created using white pine forms. The cementitious material in the concrete comprised 40% slag cement. Slag cement was used for sulfate resistance, and concrete was used to provide resistance to hurricanes. Several

Oceanfront residence

The Rowan

mockups were made to ensure that the project had minimal bug holes. This home sits between the Shinecock Bay and Atlantic Ocean. By using post-tensioned, high-strength concrete, the architect could design the house with long floor spans, maximizing the views for the owner.

Project Credits: Reg Hough Associates, Concrete Consultant; Two Trees Management, Construction Manager; Gilsanz, Murray, Stefiek, LLP, Engineer; Ruttura and Sons Construction, Concrete; Sears Ready Mix, Ready Mixed Supplier; All Island Testing Associates, Concrete Mixture Designer; and LafargeHolcim, Slag Cement.

Architectural

The Rowan, San Francisco, CA

Designed by Handel Architects, the Rowan uses exposed structural cast-in-place concrete as a key architectural design element. Located in the old industrial wing of San Francisco, CA, the Rowan consists of 71,500 ft^2 (6600 m^2) of mixed-living and residential space.

Slag cement comprised 34% of the total cementitious material used in all concrete elements of the 5200 yd^3 (4000 m^3) structure. The footing, column, and wall mixtures consisted of ternary mixtures, with 50% replacement of cement with fly ash and slag cement, to optimize workability and durability. The post-tensioned decks and tower crane pad mixtures were a blend of slag cement and Type III cement designed to reach strengths of 4000 psi (27.6 MPa) in 2 days.

The architect wanted the façade to express the building's structural elements. Other than a few interior columns, all the structure is a "exoskeleton" located at the building perimeter, maximizing tenant and rental space and creating a visually stunning design.

Project Credits: Trumark Urban, Owner; Handel Architects, Architect; Nishkian Menninger, Engineer; Build Group, Contractor; Central Concrete Supply Company, Inc., Concrete; and Lehigh Hanson, Slag Cement.

High Performance

SLS LUX, Miami, FL

This 57-story tower was designed by international architecture firm Arquitectonica and features the first LED façade by lighting artist Ana Martinez. The 450 luxury condominiums are accessed via private elevators. The top three floors include 12 penthouse residences with 12 ft (7 m) ceilings, custom gourmet kitchens, and panoramic views of Biscayne Bay and the Atlantic Ocean.

Slag cement comprised 40 or 50% of the cementitious material in most of the building's concrete (90%). The building's high-performance columns, those with design strengths between 7000 and 12,000 psi (48 and 83 MPa) were constructed using mixtures with 50% slag cement dosage. Slag cement was instrumental for achieving 12,000 psi using the locally available materials.

SLS LUX residential tower

The SCA represents companies that produce and ship over 90% of the slag cement (ground-granulated blast furnace slag) in the United States. Through a program of promotion, education, and technology development, SCA communicates the performance and sustainable benefits of this cementitious material to stakeholders throughout the construction industry. The association functions through the support and participation of member companies and for the benefit of the community at large. More information is available at **www.slagcement.org**.

Project Credits: Allen Morris Company, Owner; Arquitectonica, Architect; Consulting Engineering & Science Inc., Engineer; Moss and Associates, Contractor; Supermix, Concrete; and Lehigh Cement Company, Slag Cement.

Innovative Applications

ODOT Rt. 6 Bridge Slide, near Bowling Green, OH

For the first time in its history, the Ohio Department of Transportation (ODOT) recently removed and replaced an interstate bridge over the course of a weekend—minimizing traffic disruption by sliding two replacement bridges into place. About 4200 yd^3 (3200 m^3) of ODOT QC2 performance-based concrete was used for the two bridges. The QC2 concrete had a design strength of 5000 psi (34 MPa) at 7 days and 6800 psi (47 MPa) at 28 days, and it required RCP values below 1100 coulombs. Slag cement was used as a 25% replacement of the portland cement for concrete in the wing walls, superstructure, bridge deck, and barrier walls. The concrete was transported to the jobsite without slump loss or early stiffening in the mixer truck.

ODOT Rt. 6 bridge slide

The first bridge (for the southbound lanes) was removed and replaced on the weekend of October 16, 2015. The new bridge was placed into service on October 18, 2015. The process was repeated on the northbound lanes bridge on the weekend of December 12, 2015.

Project Credits: ODOT District 2, Owner; Arcadis Design and Consultancy, Engineer; Kokosing Construction, Contractor; Palmer Bros., Concrete; and Votorantim Cimentos/St Marys Cement, Slag Cement.