

# Innovative precast concrete pontoons instrumental to cruise ship berths

Specific requirements for cruise ship berths in Alaska led to innovative use of a precast concrete pontoon system. The City and Borough of Juneau Docks and Harbors Department contracted with PND Engineers to design two new cruise ship berths to accommodate post-Panamax cruise ships.

One goal was to move the berths into water depths of 100 ft (30 m) to eliminate the need for extensive fencing and other security measures when the ships were docked at shore. The ability of the floating concrete berths to accommodate vessels during tidal fluctuations up to 30 ft (9 m) without the need for complex loading/unloading operations is another notable feature.

The project required a phased construction sequence over two years to allow for the continued use of the existing cruise ship docks between phases. Precasting the pontoons entirely at an off-site plant was crucial to achieving this goal. As part of the berth construction, Manson Construction Co., the general contractor, retained Tacoma, Wash.–based Concrete Technology Corp. (CTC) and BergerABAM under a design-build contract for the design and fabrication of two precast concrete pontoons. The south pontoon is 300 ft (90 m) long and 50 ft (15 m) wide, while the north pontoon is 400 ft (120 m) long and 50 ft wide. Both pontoons are 20 ft (6 m) high. Each pontoon is internally divided into 18 watertight cells, and each cell is accessible from the deck via a hatch and ladder system. The in-place weight, including the weights of all appurtenances and ballasts, is 11,500 kip (51,200 kN) for the south pontoon and 15,500 kip (68,900 kN) for the north pontoon.

"Despite the notable size of the pontoons, the hull plating thickness is limited, varying between 9 and 11 in. [229 and 280 mm] at the span of the walls and the keel slab. The deck is 13 in. (330 mm) thick within its span," says Yeliz Firat, project engineer for BergerABAM. In all, 5383 yd$^3$ (4115 m$^3$) of concrete was used for the pontoons, which included concrete for the 132 precast walls and 224 precast, prestressed haunched deck panels. Once fabricated, the pontoons were towed from Tacoma to Juneau (about 1000 nautical miles [1852 km]) by Manson and installed on-site.


**The precast concrete pontoons for new cruise ship berths in Juneau, Alaska, were fabricated in Concrete Technology Corp.'s dry dock in Tacoma, Wash., and towed to Juneau, Alaska.** Courtesy of BergerABAM.

"Precasting the walls and the deck panels in the plant, erecting the precast walls in the dry dock, connecting the precast walls through pilasters in the dry dock, and casting the keel slab and the topping in the dry dock enabled fabrication of two pontoons of significant size simultaneously in 11 months," Firat says.

"BergerABAM and CTC worked closely during all stages of the design process for successful completion of pontoon fabrication by implementing lessons learned from past experience with the design and fabrication of concrete or similar pontoons," she says.

—William Atkinson

**The north precast concrete pontoon was designed to accommodate post-Panamax-sized cruise ships in Juneau, Alaska.** Courtesy of Monica Blanchard—Manson Construction Co.

# Hollow-core smart floors save energy in new schools

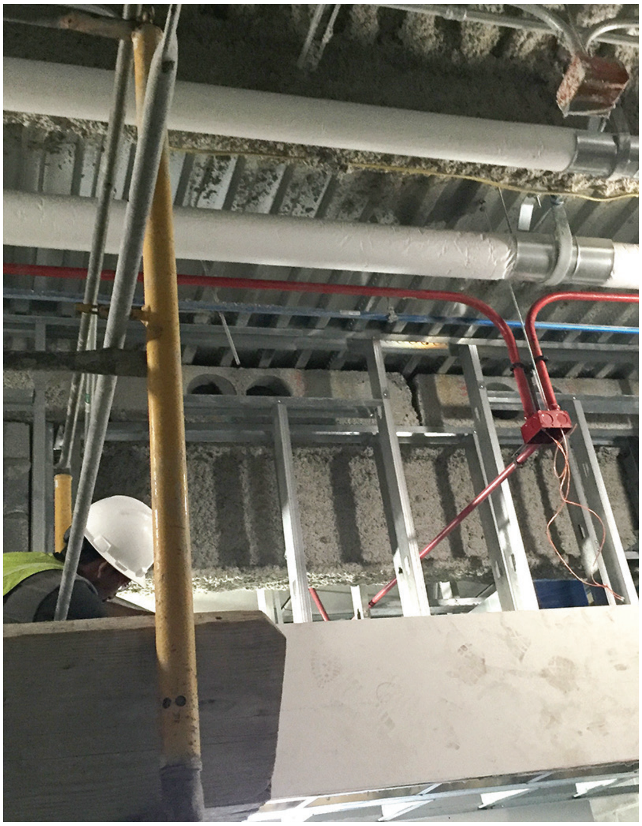
As part of an innovative energy-saving project for five energy positive schools in Myrtle Beach, S.C., Gate Precast of Oxford, N.C., produced 400,000 ft² (3700 m²) of adapted hollow-core slabs designed to function as smart floors. This is the first use in the United States of this innovative Canadian system Termobuild, which relies on the slabs' mass to store the thermal energy of heated or cooled air. SfL+a Architects is the first designer to implement this technology in the United States.

The design allows the schools to use the slabs as thermal batteries, reducing the typical daily fluctuation of energy consumption. In sum, the energy management system balances the supply of energy, allowing significantly smaller heating, ventilating, and air-conditioning (HVAC) equipment. "They will pump the conditioned air into the cores and then circulate the air back and forth," says Robert Kralowetz, part of the hollow-core sales and marketing team for Gate Precast. "They are basically storing their heat or their cooled air in the slabs. This cuts down on the mechanical equipment and the tonnage required to heat and cool the schools." As a result of the innovative system, the schools will be able to purchase more energy from their utilities at off-peak times, when energy prices are lower, in order to charge the slabs, and then discharge the heated or cooled air from the slabs during the day, when energy prices are higher.

Gate fabricated the hollow-core slabs, using the center three (of five) cores as ducts for the HVAC. Slabs were all 10 in. (250 mm) thick. Typical spans ranged from 32 to 37 ft (9.8 to 11.3 m), with weights approaching 10,000 lb (44.5 kN) each. Slabs were extruded in 4 ft (1.2 m) widths, but some were ripped to accommodate the building layout. More than 180,000 yd³ (138,000 m³) of concrete was used in production for the five schools. In preparation for the project, Gate installed three new 378 ft (115 m) long, steel formwork and purchased a new ultraspan hollow-core power plant to meet the aggressive construction schedules.

There were some challenges, though, most of which were related to notch requirements. "The design required that notches be placed across the stems of slabs to allow for continuous airflow through multiple cores," Kralowetz says. Gate experimented with multiple approaches, ultimately making notches across the stems on the extrusion bed. Then, all debris was removed from inside the cores.

**The Socastee Elementary School in Myrtle Beach, S.C., uses adapted hollow-core slabs from Gate Precast in Oxford, N.C., designed to function as smart floors.** © Tom Holdsworth.



**Contractors install the smart floor interface with the main ducts at a school in Myrtle Beach, S.C. The hollow-core system circulates stored thermal energy from the slabs' mass for heating and cooling the structure.** Courtesy of Gate Precast Co.

The design also required multiple notches to allow for installation of HVAC inlets and cleanouts. Gate provided notches in specific cores at the plant. Again, all debris was then removed from inside the cores.

Finally, notches in slabs needed to remain accessible for removal of proprietary air bladders in the field, then covered prior to topping slab placement. To address this requirement, Gate developed movable hole covers and attached them to the slabs at the plant. "These covers also protected cores from debris entering during transport and installation," he says.

The key to the success of the project, according to Kralowetz, was an open, collaborative environment within Gate. "Cooperation among sales/marketing, engineering, and production was extensive," he says. The team examined and experimented with a number of approaches prior to production. "There was also significant teamwork with the design team and general contractor up front to respond to design challenges and explore additional design requests along the way," he says.

—William Atkinson