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DESIGNING WITH PRECAST



Designer's Notebook – Formliners and Lettering

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Total-Precast Solution Provides Sturdy Data Center

Data center designed for high wind loads and heavy equipment needs relies on high-performance precast concrete structural and enclosure systems to create an attractive building that was erected quickly

— Craig A. Shutt



A data center in Georgia took full advantage of the benefits provided by a high-performance precast concrete structural and enclosure system to gain enhanced impact resistance, thermal efficiency, and other specialized features. Photo: Metromont Corp.

Designers took advantage of precast concrete to add on significant square footage to a data-center building located in a high-tech area of Alpharetta, Ga., for a rapidly expanding tech company. The design featured a total-precast concrete structural system that provided benefits to the building's structural design, façade features, and interior layout.

Data centers typically create more complex challenges than traditional warehouse/industrial-style buildings. Although their building enclosures often are similar in requiring durable, tall façades with few windows, they often demand more attention for impact resistance, thermal efficiency, HVAC requirements, and other specialized features.

Scheduling can be critical, as they can be needed to process significant amounts of transactions or data with a deadline that can't be missed for occupancy. They also can't skimp on aesthetics, as they frequently are in active neighborhoods where blending into the surroundings can create better local relationships. Providing these on a cost-effective basis can create challenges for designers.

All of these needs were met in the Alpharetta facility, which added 60,000 square feet of high-tech processing space onto the side of an existing 70,000-square-foot building handling many of the same functions. The building's precast concrete structural system comprised field-topped double tees, columns, girders, stair boxes and steps, and support compo-

nents. The precast enclosure system was composed of insulated sandwich wall panels. The components were fabricated by Metromont Corporation.

'We chose precast concrete because the envelope could be erected quickly, allowing us to get the interior dried-in faster.'

"We chose precast concrete because the envelope could be erected quickly, allowing us to get the interior dried-in faster, so we could begin to



PROJECT SPOTLIGHT

Georgia Data Center

Location: Alpharetta, Ga.

Project Type: Data center

Size: 60,000 square feet (addition onto 70,000-square-foot building)

Cost: n/a

Designer: Pieper O'Brien Herr Architects, Alpharetta, Ga.

Owner: n/a

Structural Engineer: KSI Structural Engineers, Atlanta, Ga.

Contractor: Holder Construction Co., Atlanta, Ga.

PCI-Certified Precaster: Metromont Corp., Hiram, Ga.

Precast Components: 317 pieces, including 52,768 square feet of 12- by 28-foot field-topped double tees, 32,894 square feet of 9-inch-thick insulated panels, 45 28- by 25-inch columns, and 45 girders (L-girders and inverted T-girders)

natural disaster resistance, including high wind loads, are especially advantageous uses of the material. For example, Metromont provided the structural system for a data-center project in Oklahoma City, Okla., that was designed to withstand 300-mph wind loads. "The panels we designed for this project can handle wind loads up to 150-mph and provide protection against wind-borne debris." That required the panels to be cast a little thicker than typical warehouse-style buildings would receive, with sufficient insulation to help meet their unique heating and cooling requirements.

Precast concrete also aided the aesthetic design, as the new building serves as an addition to an existing structure. The original building, built four years earlier, also was built using precast concrete. Its design featured a long, rectangular shape with a cut-out on one corner across from the building's entrance. The new nearly square addition nestled into that cut-out and aligned with the short wall on the end of the rectangular building.

"We designed it as we did so we could use the same entrance lobby for both structures, to keep the sections requiring raised flooring contiguous and maximize space without having to create a secondary entry," Hembree explains.

High Insulating Efficiency

The panels were designed by POH to provide a high level of energy efficiency by using continuous insulation to help the building control heat-

ing and cooling costs, which can rise rapidly with the significant amount of equipment being run inside. The 9-inch-thick panels feature an exterior and interior 3-inch wythe of concrete sandwiching 3 inches of expanded polystyrene foam insulation.

The high-performance precast concrete panels feature carbon-fiber reinforcement that acts as a shear connector between the inner and outer wythes of concrete, ensuring the panel has full composite action. The insulation runs edge-to-edge of the panels, as well as up to the edge of the windows, grills, and door openings, according to George Spence, business development manager for Metromont. "Because of the low conductance and small cross section of the carbon fiber, there is no thermal bridging," he explains.

'The improved heating and cooling performance for this facility will make it more efficient against future higher energy costs.'

The precast concrete panels provide thermal mass per ASHRAE 90.1 as well. This gives the wall panel a performance R-value higher than its material R-value, reaching R-20 for this application. "The improved

install the complicated processing equipment much earlier," says Jonny Hembree, project architect for Pieper O'Brien Herr Architects (POH), the architect of record. "It also gave us a very durable material with minimal maintenance needs long term."

High Wind Loads Offered

The specialized needs weren't unduly challenging from the precaster's perspective, says Mark Schaffer, business development manager at Metromont. "We do a lot of data centers, because they play to the strengths of precast concrete in their requirements. It's a good application for the system due to precast concrete's ability to handle high loads and resist high winds. It's not going to blow away in a strong wind, and it offers a good appearance while offering a resilient structure."

Buildings requiring storm and



The building's first floor features offices, while the processing equipment was placed on the second floor, with no windows interrupting the panels. Photo: Metromont Corp.

heating and cooling performance for this facility will make it more efficient against future higher energy costs, climate changes, and more extreme weather events," Spence says. "The resiliency of the precast concrete will give it the ability to adapt and endure."

The structure's frame consisting of precast concrete columns supporting 28-inch-deep x 37-foot-long double tees aided the interior design. The inherent strength of precast concrete structural systems allow for open spans with less interior columns. This typically provides more flexibility in the layout of interior spaces. The lower level of the building features open space at the center and office spaces surrounding it along the perimeter. The upper floor features multiple electrical and mechanical rooms with the complex infrastructure.

The double tees served the joint function of supporting the raised-flooring system used on the lower level while providing structural support for overhead cabling trays. "We

hung the cabling trays from the double tees," Hembree says. Embeds were placed every 5 feet along the double-tee stems to allow the supports for the cabling trays to be installed quickly to optimize wiring layouts. Four levels of cabling trays are supported from the tees.

In fact, the heaviest loads were located at the back of the house, where designers had to handle loads for piping, cooling fluids, processing water, and other specialized and heavy mechanical needs. Those spaces were designed to handle 150 pounds per square foot, compared to the roof loads that, at most, required loading of 30 pounds per square foot, Schaffer says. A precast concrete screen wall was added to encapsulate the equipment on the building's exterior, hidden from view behind an 18-foot-tall freestanding wall. "The wall had to provide a moment reaction and cantilevered out from the base, where it sits on a footing," Hembree explains. "All of that had to be accounted for in the design.

Ventilation Ducts Added

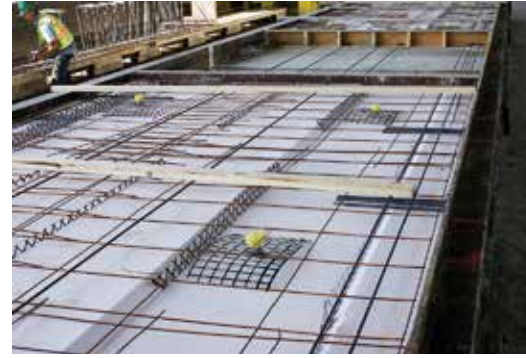
The panels used to clad the building typically were 12 feet wide and 37 feet tall and were erected in a vertical position. A variety of ventilation ducts and other penetrations were needed in some of the panels, requiring blockouts that were worked out in advance. "It's a heavily ventilated building due to the high equipment needs," Schaffer says.

Many of the vents were hidden around 3- to 4-foot-tall medallions and emblems that were cast into the panels as decorative elements, notes Hembree. "We located the medallions so they could be placed where small louvers and exhaust vents were needed, making those less obtrusive." The louvers are on the second level, placing the medallions high in a visible location. Windows were used on the first floor around office spaces. "The medallions were a key design challenge in terms of placing them and making them work as we wanted," he says.

The panels feature an off-white



The new 60,000-square-foot addition (square building) was set against the existing 70,000-square-foot longer building to allow the original lobby to serve both facilities, maximizing space for data processing. Photo: Aerial Innovations of Georgia.



The 9-inch-thick panels were cast with 3 inches of integral, expanded polystyrene foam insulation with carbon-fiber reinforcement. Photo: Metromont Corp.



The precast concrete panels cladding the building were typically 12 feet wide and 37 feet tall, with blockouts for ventilations ducts and other HVAC needs added on the second level. Photo: Metromont Corp.



The panels feature an off-white face mix with a light sandblasted finish, which matched the finish on the original building erected four years earlier by the same design and construction team. Photo: Metromont Corp.



First-floor panels features a variety of windows cast into the panels, with interior insulation running up against the penetrations. Photo: Metromont Corp.

face mix with a light sandblasted finish. The back side features a traditional gray color with a steel-

troweled finish that ultimately was painted after erection. The mix is similar to the one used on the origi-

nal building, for which Metromont and POH had the original drawings. "The architectural team worked on the original building, so they were able to provide the mix design in the drawings that they wanted to match," says Spence.

No sealers were used on the panels after a discussion with the client concerning the pros and cons, Hembree notes. "We didn't want to add maintenance issues down the road when they had to be reapplied." Instead, the crews applied a double sealant bead on all joints. "The client wanted to ensure a belt-and-suspenders approach to cover all contingencies while keeping costs within the budget."

The result was a building that met all of the highly complex functional needs while providing an aesthetically pleasing, cost-effective, and quickly erected design. 

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