

METAL STUD CRETE WINS THE RACE

Project gains unexpected benefits switching to thin-shell concrete.

The Domus project is an 8-story residential complex in Philadelphia, PA, incorporating 414,000 square feet of premium residential and retail space, plus 108,000 square feet of parking. The complex covers a large city block, and its vast exterior surfaces were initially designed for masonry, including a wealth of visual details to harmonize with the brick facades of the adjacent University of Pennsylvania. When construction documents were 65% completed, developer The Hanover Company, Houston, TX decided to accelerate construction. Groundbreaking was scheduled for December 2005, and they wanted to try to enclose the structure before the onset of the following winter. Masonry was deemed to be too slow to achieve that goal. They wanted the speed of precast erection, but they did not want to increase the loads on the structure and force a major re-engineering of the project so late in development. Thin-shell seemed like the answer.

An engineering firm with expertise with thin-shell construction was brought in, IECS LLC, Warrenton, VA. IECS recommended the Metal Stud Crete system, with which they had previous, positive experience. Metal Stud Crete uses the same type of concrete as conventional precast, though in an unconventional way. The heart of the system is a proprietary galvanized steel shear-transfer strip with Y-shaped flanges. The strip is screwed to light-gage steel studs which have been assembled into a panel. The panelized steel is placed on the precaster's forms with the shear-transfer strip's flanges projecting downward. Other than the addition of the steel, the casting form is set up in the usual way, including welded-wire mesh reinforcing in accordance with design requirements, but the entire mold is only 2 inches deep. The flanges become embedded as the concrete is placed.

A Metal Stud Crete wall with 2 inches of concrete can be as much as 70% lighter than conventional precast, yet the combination has composite strength and can be used as load-bearing wall, not just exterior cladding or curtain wall. Structural testing, and use in hundreds of projects throughout the US, have verified that the bond of the concrete to the metal framing assembly through the Metal Stud Crete shear connectors achieves full composite action. The system is approved under International Code Council (ICC) Evaluation Service Report ER-5446.

Because the concrete and the steel are standard, easily available materials, the Metal Stud Crete system can be used by any precaster. Architectural Precast Inc. (API) Middleburg, PA, a well-established precaster in the region, was chosen for Domus. API had never done a thin-shell project before, and Domus was an unusually large and complex project involving four different finishes. It was a bold undertaking, and Trent Mattern, president of API, acknowledges there was a learning curve to integrating steel framing into the precast process. "We knew

that there would be some challenges along the way, but we have 40-plus years in the precast business. We felt highly confident that we'd be able to take this product and produce it in our plant."

ADDED ATTRACTIONS

As the project developed, it became apparent to all parties that they had gained more than time. The space gain achieved by eliminating an interior furring wall impressed IECS managing director Michel Cateau. "You save quite a bit of space, typically 3-4 inches all the way around the perimeter of the building." This is especially valuable in an urban project where maximum footprint is strictly limited by lot size and building code, and every square foot gained translates into profit. With Domus' average rental unit of 1024 square feet, it adds space equivalent to an extra storage closet in each unit, at no cost.

Domus also utilized a special Metal Stud Crete option that maximizes thermal insulation. The thermal standoff version of the sheer transfer strip separates the face of the steel studs from the concrete surface by 1/2 inch, improving thermal resistance and reducing potential for condensation. Combined with larger panel sizes to minimize joints where air can infiltrate, this creates a residence that's well adapted for both the cold winters and stifling summers of the Philadelphia area.

IECS created an innovative use of precasting that made fire-resistance an integral part of the panels and saved construction costs. They designed an integrated firestop, a horizontal beam cast in the interior surface of the panels. Normally, this would have to be added by the contractor after erection to seal the wall against floor-to-floor fire migration. The integral firestop did double duty, according to API project manager Kenny Luck. "We placed the weld-plates within the fire cavity for connection to the slab. It was the most logical place to put them."

This kind of creative thinking is becoming familiar to Paul Clark, Vice President of Metal Stud Crete. "Thin shell is proving to be a powerful tool for designers," says Clark. "An exciting new technology always inspires innovation. Architects and engineers all over the country are finding new ways to use Metal Stud Crete every day, and we're constantly being educated about the versatility of our own product."

Perhaps most impressive, the architectural finish was not compromised by abandoning hand-constructed masonry and switching to thin-shell precast. On the contrary, it was improved. The architect knew that facades so large needed a lot of detail to relieve the eye. However, the expense of executing it in masonry was so great that the project could only afford decorative detailing on the two most visible facades. With thin-shell precast, beautiful detail was affordable on all the sides. "We were repeating what the form work was already doing in the

rest of the building,” explains architect Mike Goodwin of The Design Collective, Baltimore, MD.

Concerning finish quality, Trent Mattern comments, “The aesthetics rival traditional precast. Thin-shell doesn’t lose anything that way.” Architect Goodwin goes even further. “We were able to do some very nice moves, unique to the thin-shell system, that we couldn’t afford with masonry.”

The project boasts four colors with varying textures, including a limestone-effect buff around the base, gray sandblast, medium sandblast to reveal aggregate, and acid-etch terracotta. API cast as many as three different colors in a single panel. “We had a subset of forms we used,” explains Luck. “We poured the first color, let it set up partially, pulled the form out, cast the second color in place, etc.” Brick patterning and complicated reveals were created using form liners.

Mattern admits it was a big challenge to adopt unfamiliar technology on a huge and complicated project. While the learning process was occasionally frustrating, he feels it was worth it. “If we can accomplish a job of that size and beauty on our first project, the sky’s the limit for what we’ll be able to accomplish in the thin-shell market.” Architect Goodwin is equally enthusiastic about the accomplishment. “The finish is spectacular. The panels look beautiful.”

LOOKING FORWARD

As of this writing, Domus is still under construction, but it is on-track to be enclosed before Winter.

The Domus experience convinced API’s Mattern of the viability of thin-shell construction and its place in his future. “It has a lot of great benefits: lower trucking and erection costs, being able to attach the insulation and drywall right to the studs... We’re starting to see a lot more high-end apartment and condo-type buildings going up, which is a perfect application for this product.”

Additional Information: www.MetalStudCrete.com