

PRECAST LIGHTENS UP

WITH LIGHTWEIGHT PRECAST WALLS, THE SKY'S THE LIMIT.

BY MICHAEL CHUSID, RA FCSI

EDITOR'S NOTE

The system featured in this article is among a variety of lightweight thin-wall systems available today. To locate manufacturers of thin-wall systems, please visit precast.org, click the "Find a Product" link and use the search term "wall panel" in the search form.

The advantages of precast concrete – durability, fast erection, fine architectural finish – are well known. The possibilities for its use are limited only by its size and weight when transporting and installing it. Recently, however, a new type of precast concrete that minimizes the burden has been added to the designer's toolbox.

Lightweight precast wall systems, integrating concrete with light-gauge steel framing, cut the weight but retain most of the advantages. The lightweight concept is expanding the range of projects where precast is the answer.

Lightweight wall systems marry light-gauge steel framing to a thin concrete panel creating a complete exterior wall. Utilizing as little as 2 inches of concrete instead of the customary 4 to 6 inches, these panels can weigh 60 percent less than conventional precast, yet provide composite strength for use as load-bearing walls as well as cladding and curtain walls. Lightweight wall systems reduce deadloads on the entire structure, saving weight – and money – down to the foundation.

Another advantage is space savings. Integral steel studs eliminate the need for interior furring, resulting in a thinner wall overall. This increases net usable floor space by several inches around the entire perimeter of the building. It also saves time and expense, since studs provide ready-made cavities for insulation and utilities, and interior finishes can then be attached directly to the studs.

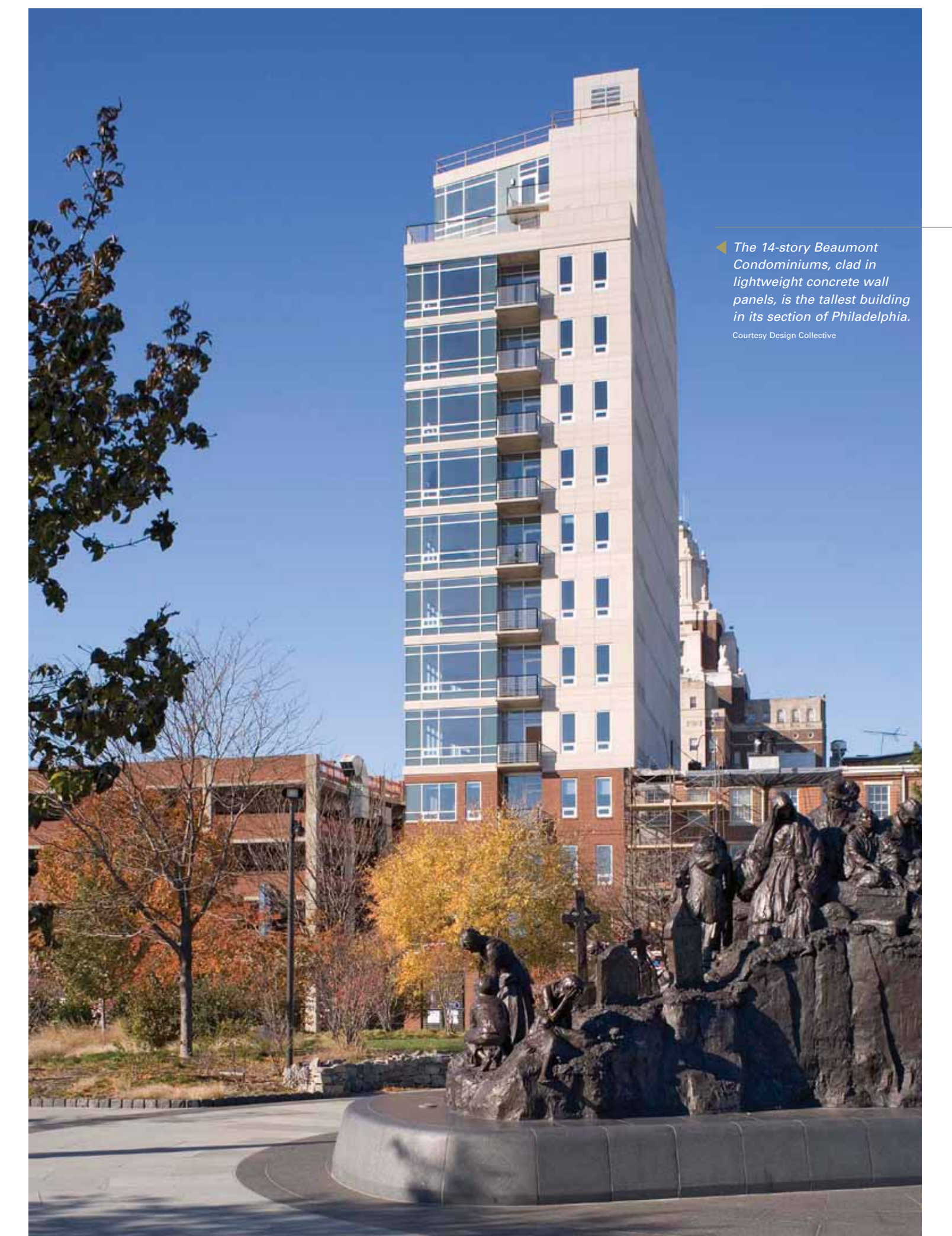
Wall panels can be cast off site while foundations are

being placed then delivered to the job site on an as-needed basis. Lightweight panels can be handled more easily using lighter equipment. Alternatively, it becomes practical to precast much larger panels, which speeds construction and minimizes the number of panel joints. Lighter weight and fewer pieces mean that shipping costs less and erection can be faster than conventional precast panels.

Lightweight wall systems are also more sustainable for "green" building. Lightweight wall panels reduce greenhouse gases, because they consume less portland cement, a major source of CO2 emissions. Concrete and steel framing can be made from recycled content. Lighter panels make trucking more efficient, which reduces energy consumption and vehicle emissions. Use of larger panels with fewer panel joints minimizes air infiltration to save energy for heating and cooling the building. And thermal performance can be improved even further by using 6-inch studs and increased insulation.

Lightweight wall panels are proving to be a powerful tool for designers, according to Paul Clark, vice president of Metal Stud Crete, a popular lightweight precast wall system. "An exciting new technology always inspires innovation. Architects and engineers all over the country are finding new ways to use it, and we're constantly being educated about the versatility of our own product," he says. "I believe it is changing the face of construction."

One reason for the company's widespread adoption



◀ *The 14-story Beaumont Condominiums, clad in lightweight concrete wall panels, is the tallest building in its section of Philadelphia.*

Courtesy Design Collective

Concrete is married to light-gauge steel studs by means of shear transfer strips. Welded-wire mesh is sufficient to reinforce the thin-shell concrete, because the steel framing is designed to carry axial and transverse loads.

Courtesy Metal Stud Crete



is that the system can be used by any precaster, and it saves time. Because of the reduced weight, overnight curing typically achieves sufficient strength for the assembly to be lifted out of the forms the next day, speeding the casting beds' cycle time as compared with conventional precast. Panels can then be moved to a storage position to continue curing before shipment.

SMALLER LOADS, BIGGER PANELS

Although it is a proven technology, the ramifications of the lightweight design are still being explored. Architects and engineers who turn to lightweight wall panels to solve specific problems often discover additional benefits. This was the case with The Munger Research Center at the Huntington Library, San Marino, Calif.

The Munger Research Center, located in one of the most seismically active areas of North America, was designed as an essential structure to protect one of the world's premiere collections of rare books and manuscripts. Building to 150 percent of code, the deadload of conventional precast would have required huge expense in the support structure. Designer/builder Earl Corp., Irwindale, Calif., selected lightweight wall panels weighing 35 to 45 pounds per square foot rather than the 100 to 140 pounds per square foot for conventional precast. According to structural engineer Jackson Wu of Johnson & Nielsen Associates, Monrovia, Calif., "We would have needed an average 8

inches of conventional concrete. By using these panels, we reduced the weight about 65 percent." He estimates this choice cut more than 1,000 tons of dead load from the 90,000-square-foot building.

Precise interior climate control was one of the primary requirements of the building in order to protect the valuable collection. The light weight of the wall system made it practical to transport and erect very large panels, minimizing the number of joints to be sealed against air and moisture infiltration. Panels as large as 16 feet tall by 40 feet long were produced by Coreslab Structures Inc., Los Angeles. Bob Konoske, vice president and general manager of Coreslab, comments, "It was very aggressive to make precast panels this large. Practically, we could not have made conventional panels this big." The entire interior surface of the precast panels was sprayed with closed-cell foam to achieve a moisture barrier and thermal break. Temperature in the building can be maintained to within a tolerance of plus or minus 1 degree F.

The large panels made it possible to locate joints where they could be concealed by architectural elements: vertical joints occur at changes in wall plane and horizontal joints are behind moldings. The broad, apparently unbroken concrete surface achieves a monolithic appearance not possible with individual quarried blocks. To harmonize with the neoclassical style of the Huntington's original buildings, the concrete is finished to look like natural stone, and entrances and

▼ *The five-story medical research facility at the University of Indiana, Gary, Ind., replicates the appearance of Indiana limestone at a lower cost. The light weight of the panels enabled the producer to ship more panels per truck.*

Courtesy Metal Stud Crete



windows have 24-inch recesses to create dramatic shadows and the illusion of massive walls.

FAST AND FRUGAL

Lightweight precast wall panels were chosen by The Hanover Co. in Houston to accelerate construction on its Domus residential project in Philadelphia. Construction documents were 65 percent complete when the schedule was accelerated to enclose the structure before the onset of the following winter. The project was originally designed for brick construction to complement the brick facades of the adjacent University of Pennsylvania. Switching to precast gained the needed speed, and using lightweight wall panels accomplished it without increasing loads – a significant budget and scheduling factor so late in the design phase.

Other savings followed. Trent Mattern, president of Architectural Precast Inc. (API), Middleburg, Pa., the precaster for the project, says that lightweight panels have a lot of great benefits. “Lower trucking and erection costs, being able to attach the insulation and drywall right to the studs ... The aesthetics rival traditional precast. You don’t lose anything that way,” he says.

“You save quite a bit of space,” adds Michel Catteau, managing director of the Domus engineering firm, IECS LLC, Warrenton, Va., “typically 3 to 4 inches all the way around the perimeter of the building.” This is especially significant in an urban project, where space is limited and every added square foot translates into profit.

IECS realized additional savings by designing a horizontal beam cast in the panels to act as a fire stop against floor-to-floor fire migration. Normally the contractor would have borne the expense of adding a fire stop after panel erection. The firm also specified Metal Stud Crete’s optional thermal standoff to separate the steel studs and concrete surface by one-half inch to improve thermal resistance and reduce condensation potential.

Probably the biggest gain on the eight-story, 522,000-square-foot complex was in architectural finishes. In the original masonry design, decorative motifs and other architectural detailing was too expensive to execute on all but the two most visible

facades. With lightweight wall precast, beautiful details on all walls became affordable. "We repeated what the form work was already doing on the rest of the building," explains architect Mike Goodwin of The Design Collective, Baltimore, Md. He adds, "We were able to do some very nice moves unique to the lightweight system that we couldn't afford with masonry."

API produced panels highlighted by complicated patterns and reveals, including up to three different colors on a single panel. Form liners and sandblasting were used to create textures and brick pattern, too. "The finish is spectacular," exclaims Goodwin. "The panels look beautiful."

A THINNER FUTURE

The thinning of architectural precast appears to be a movement that is gathering speed. The advantages of reduced loads, faster construction, increased usable floor space, improved climate control, sustainability and beautiful finishes at lower cost are prompting developers and designers to consider precast for a wider variety of projects. Lightweight precast wall

panels are being used in all parts of the United States for high-rise and low-rise commercial, institutional, residential and medical buildings. Any precast manufacturer can join the lightweight revolution, bringing valuable precast expertise to an expanded range of architectural challenges.

API's Trent Mattern acknowledges there was a learning curve to integrating steel framing into the precast process. After 40-plus years in the precast business, he says, "We felt confident that we'd be able produce it in our plant, but we also knew that there would be some challenges along the way. In the end, looking at the building, it's amazing that our guys were able to do what they did on their first job with the system, especially considering the size and beauty of that job. If we can accomplish a job like that, the sky's

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