The District at Howell Mill
Phillips Partnership, Atlanta, Ga.

Bayshore Building N
Meacham & Apel Architects Inc., Dublin, Ohio

Precast Streamlines Mixed-Use Projects

Architects cite flexibility, economy, and speed of construction as key factors in choice of material for structure and cladding

— Wayne A. Endicott

Mixed-use projects, which combine several functions in one location (for example, retail, residential, office space, and parking) are fast becoming popular options for developers, due to the range of users they bring to the site throughout the day. But the trend also creates a key challenge: How do you combine the uses most efficiently to generate the most revenue?

A good answer often includes specifying precast concrete components for the building's shell and cladding, according to a number of architects who design such multi-use projects. Precast concrete provides multiple benefits for facilities that need to meet a variety of functions, says D. Brett Oaks, design principal with DMJM Design in Phoenix, Arizona.

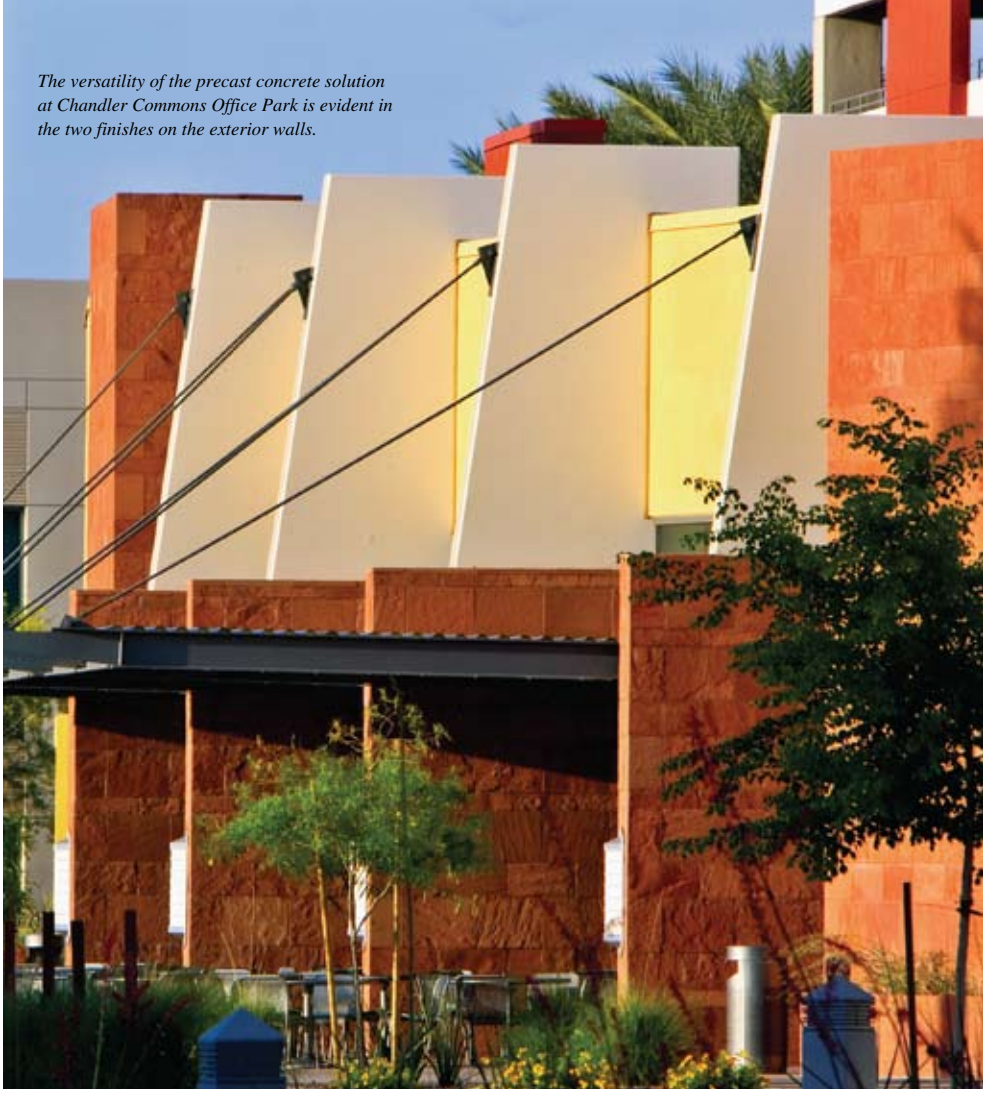
"Constructability and cost are two of the most important factors to consider in these projects, and precast concrete can help with both," he says. "Precast also offers scheduling advantages and aesthetic benefits, while also addressing functional issues such as fire safety." All were key reasons why standard precast concrete components were specified for the Chandler Commons Office Park Phase 2 in Chandler, Arizona. It combines an 850-car parking structure with a cafeteria and fitness center, meeting rooms, a shipping/receiving area, and storage space.

Dwight Bailey, a designer with Phillips Partnership in Atlanta, Georgia, echoed those sentiments. The senior project manager for The District at Howell Mill in Atlanta, Bailey adds that precast concrete can help reduce design time. "The precast design can take place simultaneously with the structural design, cutting planning time significantly."

Time is a major consideration for these projects, he says, and the ability to reduce planning time can have a significant impact on the completion date. Finishing quicker means revenues can be generated faster through rents, parking fees, special events,

Chandler Commons Office Park Phase 2
DMJM Design, Phoenix, Ariz.

The entrance to the ground-floor cafeteria is shown in the foreground at Chandler Commons, with the parking structure in the background.



The versatility of the precast concrete solution at Chandler Commons Office Park is evident in the two finishes on the exterior walls.

Fact Sheet

Chandler Commons Office Park Phase 2

Location: *Chandler, Ariz.*

Developer/Owner: *Countrywide Home Loans, Chandler*

Architect/Engineer: *DMJM Design, Phoenix, Ariz.*

Contractor: *Hunt Construction Group, Phoenix*

Precaster: *Tpac, a division of Kiewit Western Co., Phoenix*

Project Size: *324,240 sq ft*

Precast Concrete Components: *956 pieces, comprising twenty-four 20 in. double tees, four hundred twenty-five 24 in. double tees, 81 beams, 32 hollow-core slabs, 75 columns, 118 exterior spandrel panels, 23 exterior wall panels, 40 interior ramp-rail beams, 109 interior shear-wall panels, 20 stair/elevator walls, and 10 grade walls*

Project Cost: *$17 million*

'Constructability and cost are two of the most important factors to consider in these projects.'

and other activities. The Atlanta project, in the heart of the city, includes apartments and retail, as well as parking that serves both uses.

Balancing Functions

Determining the proper balance between the functions in a multi-use project creates a real challenge, Bailey notes, becoming a chicken-or-the-egg question that has to start with one given before providing supplemental needs. At The District at Howell Mill, for example, the retail space was the developer's key target. Once the amount of retail space was decided, planning for ample parking space fell into place. Finally, an adjacent residential component was factored in.

The process proved somewhat different in the case of Bayshore Building N in the Milwaukee suburb of Glendale, Wisconsin. There, the first consideration was the type of housing to be included in the town-square-style development, according to Michael Karpinski, an associate with Meacham & Apel Architects Inc. in Dublin, Ohio. "After that, making it work with the parking and retail components essential to the town center was the challenge."

Speed was a driving force in the selection of precast concrete for the structural system for Bayshore, he notes. "We were literally behind when we started, according to the developer's timetable." The lagging schedule dictated that much of the construction take place during winter, another situation in which precast concrete excels, as erection could continue even through the harsh Wisconsin winter. To keep the project on the tight schedule, it was necessary to hold early discussions with the precaster, Spancrete in Waukesha, Wisconsin.

In fact, all three of these projects brought the precast concrete producer into the process during the planning stages to take full advantage of that input. "The precaster was part of The District at Howell Mill from its inception," Bailey says about the participation by Tindall Corporation in Conley, Georgia. "It was important to have their input upfront. It reduced

planning time, because they could develop their drawings while we focus on the building's design without having to worry about designing the precast concrete."

At the Chandler Commons project, Tpac, a division of Kiewit Western Co. in Phoenix, was also brought on early, notes Oaks. That participation allowed the design team to plan the structure with immediate feedback, including such considerations as the cost impact of proposed design concepts. As a result, the design team could better control the project budget. "The early selection of the precaster meant that precast shop drawings were developed as the architectural and structural construction documents were being completed," Oaks explains. That timetable shortened the overall project schedule.

Precast Provides Versatility

Although these three projects share the common bond of featuring precast concrete components, they are decidedly different, emphasizing the versatility of precast concrete systems.

The most extensive use of the material was in The District at Howell Mill in Atlanta, which blends upscale shopping with everyday needs and offers a 435,000 sq ft, pedestrian-friendly retail environment in a tight urban setting. The three-tiered structure includes a Wal-Mart at grade level, parking on a mezzanine level, and parking, retail, hardscapes, and truck delivery on the top level.

Constructed on a dense site, the development was limited to 9 acres sandwiched between Interstate 75, which carries 400,000 vehicles per day, and an operating grocery store/strip mall. To clear the site, an existing motel had to be removed. Then, due to the presence of a riverbed that would not drain, a 40 x 330 ft detention vault and a 30-ft-tall and 500-ft-long retaining wall had to be constructed.

The complex structure consisted of a total-precast concrete solution on the lower portion and numerous steel superstructures utilizing various lateral-force-resisting systems that carry height and loading criteria. The precast concrete components comprised field-topped double tees, bulb double tees, and W-beams, using precast concrete moment frames and shear walls for lateral stability.

The mezzanine level, which is subjected to standard parking loads, used standard precast concrete shapes, including inverted tee beams and double tees. The platform, however, at 31 ft above grade, features a 36-in.-deep W-beam system in areas that required continuity due to load and fire requirements.

Several engineering challenges arose in placing the Wal-Mart structure beneath the platform. This location resulted from the developer wanting the store as close to the retailer's standard as possible, which precluded the use of shear walls in the footprint. This was addressed by using a 60 x 30 ft, two-way moment frame. The upper floor was designed as the slab for retail stores and limited parking.

Retail structures bearing on the platform use structural-steel moment or braced frames, which required coordinating precast concrete and steel structures to account for large seismic forces and gravity loads. Because of the nature of the site, one corner of the precast concrete platform cantilevers in the horizontal direction approximately 12 ft while still accommodating the steel structure above.

Seismic Concerns Addressed

Another challenge met by the design team concerned the diaphragm torsion in the eastern side, at the Wal-Mart loading dock. The many solid, full-height precast concrete wall panels in the north-south direction were stiff enough that each could have acted as a shear wall. However, only a few were actually designed to be shear walls, and the non-shear walls would need to withstand significant seismic forces, so their lack of ductility could pose a problem. To resolve this, the architects designed the structure so these walls could slip, reducing the seismic force.

The design team determined that the best location for the loading dock was on the back side of the structure, where the building was as little as 25 ft from an interstate expressway ramp. To provide maneuvering space for tractor-trailer deliveries, Tindall designed free spans of up to 140 ft over the loading dock, an unprecedented span, Bailey notes.

The beams, varying in length from 67 to 147 ft, aid vehicle access on grade as well as support the 150 psf live loading above for the warehouse retail stores. Because a column support at the building edge was not

'Monster' Beams Meet Design Challenge

Heavy loads and long spans are typical in the construction of bridges, but in a commercial application, such "monster" beams or structural girders require a different approach.

For The District at Howell Mill project in Atlanta, Georgia, the decision was made to cast smaller standard pieces and then deliver them for on-site assembly. This approach can be used in structures where spans are longer than 60 ft with an upper span limit set by access and weight limitation. In the case of Howell Mill, the design called for spans running up to 140 ft with relatively heavy loads.

These beams featured standard precast concrete sections dependent only on the precaster's production capabilities.

The long-span beams at Howell Mill varied in length from 80 to 140 ft and were up to 15 ft deep. As is readily apparent, they are too large to be created by a monolithic concrete placement or shipped by truck. To create these beams, they were designed and produced in components as standard shapes—a top flange, a web, and a bottom flange.

The top flange consisted of a 3-ft-wide, 25-in.-deep U-beam, similar to a W-beam. Concrete for the vertical web of the beam was placed on its side much like a wall panel and prestressed. The bottom flange is a 3-ft-deep, 3-ft-wide inverted-tee beam. The U-beams and flat panels were preassembled at the plant as panels.

The bottom of the web featured a saw-tooth panel that fit into a similar saw-tooth panel on the bottom flange. At the site, the beams were joined together using mechanical fasteners, then grouted together to form a monolithic structure.

The beams for the Howell Mill project were created in pieces that were then assembled on site.

'Precast allowed us to create a finely detailed, exposed exterior, using a variety of surface finishes and textures.'

Bayshore Building N in Glendale, Wis., includes retail, parking, and services on the first floor, two additional levels of parking, and three floors of residential apartments.

The speed with which the precast concrete components could be erected, such as the double tees in the parking structure, were a key reason they were specified for the Bayshore Building.

Fact Sheet

Bayshore Building N

Location: *Glendale, Wis.*

Developer: *Bayshore Town Center LLC, Columbus, Ohio*

Architect: *Meacham & Apel Architects Inc., Dublin, Ohio*

Engineer: *Jezerinac Geers & Associates, Dublin*

General Contractor: *Corna/Kokosing Construction Co., Westerville, Ohio*

Precaster: *Spancrete, Waukesha, Wis.*

Precast Specialty Engineer: *Spancrete / Computerized Structural Design LLC, Waukesha*

Project Size: *638,838 sq ft (90,518 sq ft of retail and 70,950 sq ft of parking/ services on the first level, two levels of parking of approximately 159,800 sq ft per level, and three floors of apartments of approximately 52,585 sq ft per floor)*

Precast Concrete Components: *106 columns, 134 beams, 525 double tees, 97 load-bearing spandrels, 36 non-load-bearing spandrels, 139 wall panels, 51 hollow-core slabs, and 76 stairs/landings*

Project Cost: *$41.5 million*

an option, a transfer girder spanning 50 ft was created as well (see the sidebar for more information).

To control vibration transmissions, the project was divided into seven independent structures with expansion joints isolating the vibrations of the automobile live loads from the retail structures. Each structure required a lateral analysis, which was affected by the retail, parking, or sidewalk on the top level. Seismic joints divide the mixed-use superstructure into four seismically detached structures, each of which was analyzed separately.

"What we supplied to The District was pretty much all standard precast—basic components," notes Joe Golden, sales manager for Tindall. "That we were able to satisfy all of the needs with our standard products attests to the versatility inherent in the product."

Creating a Town Center

Standard components also make up the Bayshore Building N, according to Karpinski. The structure includes 90,518 sq ft of retail space on the ground level, 70,950 sq ft of parking and services on the first level, two additional levels of parking space with 159,800 sq ft of parking per level, and three floors of residential apartments with approximately 52,585 sq ft per floor. In all, the 531 x 308 ft project includes 638,838 sq ft, of which the precast parking and retail encompass 481,000 sq ft on three levels. Parking space can accommodate about 1,000 vehicles.

Built under a design-build contract, the project features precast concrete for a variety of reasons, Karpinski says. The components meet specific bay-size requirements for retail, achieve the required spans for the parking decks, and meet the requirements for fire safety without needing additional fire-protection materials. Additionally, the precast concrete provided a transfer level for the erection of the residential floors and permitted construction to proceed during the winter months.

Design flexibility was a strong factor in the choice of precast concrete for the project, he says. "The precast allowed us to create a finely detailed, exposed exterior, using a variety of surface finishes and textures." The wall panels could also be matched easily to surrounding structures. As well, the components could be designed to accommodate growth by reconfiguring existing interior spaces, thanks to designing the precast concrete beams with long spans, creating large open areas without obstructions.

Other traits that factored into the decision included the fact that the durable, fire-resistant material also lowers maintenance costs and insurance rates. The plant's established quality-assurance program also ensured consistency in the finished product, requiring no worries about differences between panels. The design of repetitive panels and reuse of molds also saved production costs.

"We've participated in quite a few mixed-used development projects over the years," says Kimberly Wacker, director of marketing and business development for Spancrete. "Precast concrete has inherent advantages that resonate in the building industry:

durability, fire resistance, design flexibility, and all-weather construction."

Spancrete was involved in the design of the project virtually from the beginning, she adds. "The earlier we can become involved in a project, the more input we can provide in the design to optimize construction efficiency." Bayshore was built even while the adjacent mall remained open and operating, another advantage to the use of precast concrete. Components were fabricated off-site, trucked to the erection site, and then rapidly lifted into place.

Blending with Neighbors

Of a somewhat different character is the Chandler Commons Office Park structure. It integrates parking, a cafeteria, and a fitness center under one roof. The design team at DMJM Design specified precast, prestressed concrete for several reasons, Oaks says. A key reason was its ability to match the context of existing buildings in the complex. The project includes double tees for most of the parking area with hollow-core panels used for shorter spans. Also included were spandrel panels for the structure's exterior walls.

A major advantage to using precast concrete, in addition to its versatility, was its capability for long life, says Oaks. Also, the variety of spaces, including the parking, cafeteria, and workout room, as well as meeting rooms and storage, required a variety of ratings for horizontal fire separation. "We could provide those requirements with precast concrete without needing to apply additional fireproofing materials."

The use of precast concrete not only aided speed in both production and erection of the building, but it also gave designers a variety of aesthetic choices. Another factor was that, due to the building's close proximity to existing office structures, there was minimal space to stage materials.

By bringing Tpac into the design process early, the design team received immediate feedback on aspects that included the cost impact of proposed design concepts. This provided better control over the project budget.

"We were not originally married to precast for this project," Oaks says, "but as various ideas were developed, it became apparent that it would give us more design options by offering us the capability to provide different surface textures, patterns, and reveals. That let us create an interesting building that fits well into the context of the office park." Production shop drawings also were created as structural documents were being completed, allowing the project to be built well within a tight schedule.

The precast concrete allowed the construction team to closely control costs and schedules. The project used standard precast concrete products, says Tpac's Randy Garmon. With the precaster's input, any potential problems were quickly identified and resolved with the designers and the company's engineering staff.

All three architects echoed the sentiment that precast concrete would receive prime consideration for any future mixed-use project they might design. Those projects no doubt will continue to grow as developers find that combining functions creates more useful and functional buildings that can be used all day long. ■

For more information on these or other projects, visit www.pci.org/ascent.

Construction workers prepare to hoist the top flange of one of Howell Mill's beams into place.

Fact Sheet

The District at Howell Mill

Location: *Atlanta, Ga.*

Developer: *Selig Enterprises, Atlanta*

Architect: *Phillips Partnership, Atlanta*

Engineer: *Haines, Gipson & Associates Inc., Lawrenceville, Ga.*

General Contractor: *Benning Construction Co., Smyrna, Ga.*

Precaster: *Tindall Corp., Conley, Ga.*

Precast Specialty Engineers: *Berger/ABAM Engineers Inc., Federal Way, Wash., and The Consulting Engineers Group Inc., San Antonio, Tex.*

Project Size: *450,276 sq ft (including 16,000 sq ft restaurant, 307,000 sq ft of retail space, and 336,000 sq ft of elevated parking)*

Precast Concrete Components: *251 square columns, 103 W-beams, 45 shear-wall panels, 59 stair/elevator panels, 39 rectangular beams, 10 wind beams, 33 spandrel beams, 6 spandrel panels, 7 long-span I- beams, 71 inverted-tee beams, 3 L-beams, 660 double tees, 224 bulb tees, 25 flat slabs, 50 architectural brick-tile panels, 21 brick-tile spandrel beams, and 61 spandrel panels*

Project Cost: *$47.5 million*