Parking Structures Bet on Precast Concrete

— Craig A. Shutt

Gigantic casino parking facilities have special needs that precast concrete components help designers meet efficiently

River Rock Casino Parking Structure
Geyersville, Calif.

Casino owners face unique challenges in creating parking structures to support their gaming operations. Designers have discovered that precast concrete systems can help meet many of these goals, regardless of the distinctive requirements and site logistics. Three recent projects show the range of what can be achieved.

"What drives designs for casino parking structures the most is how quickly you can get people parked and get them inside to spend money," says David Giles, senior associate at FFKR in Salt Lake City, Utah, and the project manager for the River Rock Casino Parking Structure in Geyserville, Calif.

Owners are willing to sacrifice spaces if it creates more efficiency, adds Matt Jobin, project manager for Rich & Associates in Southfield, Mich., and the project manager on the Greektown Casino in downtown Detroit, Mich. "Other owners see every parking space as a dollar value, and they don't want to lose a single one," he says. "But for casino owners, parking time is money. So if the turns are too tight, they'll let us take out spaces to make it easier."

With the 13-story, 2700-car Greektown structure, designers installed electronic signs at ground level and at each level's ramp to provide counts of the number of open parking spaces overall and per floor, respectively. That ensures that drivers know whether to tour a level looking for a space or head higher up. These systems are becoming more commonplace for large parking structures and are typical for casinos.

Casino visitors can arrive at any time of the day or night, but there are peaks when traffic still must move well, notes Jobin. "This garage will fill up on Saturdays at 7 p.m., so there is ebb and flow," he says. Mike Albers, project manager at Walker Parking Consultants in Wayne, Pa., agrees. The firm recently completed work on Bally Caesar's Transportation Center in Atlantic City, N.J., a 10-level, 1 million ft^2 project. "Casinos have entertainment venues with 1000- to 6000-seat shows, so spikes in traffic volumes must be accommodated."

Many casinos, such as Bally Caesar's, also must accommodate a variety of parking formats, including self-park, valet parking, taxi arrivals, and employee locations. These circulation routes, as well as those for limousines and buses, must be laid out to maximize efficiency for all.

Time Is Money

Casino owners are not only anxious to get visitors into the gaming

For the total-precast concrete parking structure for the new River Rock Casino in Geyersville, Calif., designers took advantage of the sloping road to ensure that each level had direct access, eliminating the need for ramps.

The use of precast concrete components allowed designers to minimize construction time and construction traffic to the site along a narrow, winding access road.

The parking structure was built against new retaining walls that were constructed to support the hillside, an active slide plane.

Fact Sheet

Project: *River Rock Casino Parking Structure*

Type: *Casino parking structure*

Location: *Geyserville, Calif.*

Designer: *FFKR Architects, Salt Lake City, Utah*

Engineer: *URS Corp., San Francisco, Calif.*

Contractor: *Swinerton Builders, San Francisco*

Owner: *Dry Creek Rancheria Band of Pomo Indians, Healdsburg, Calif.*

PCI-Certified Precaster: *Hanson Structural Precast Pacific, Irwindale, Calif.*

Precast Specialty Engineer: *Calder Richards, Salt Lake City*

Size: *1 million ft²*

Precast Concrete Components: *814 double tees, 337 solid deck slabs, 310 hollow-core slabs, 267 columns, 20 stair risers, 123 planters, 44 wall panels, 166 fascia panels, 404 L-beams, 132 rectangular beams, 355 spandrel panels, 169 planter cap plates*

Project Cost: *$27 million*

To speed the design phase, the designer brought in two precasters to work out details.

rooms, they're also eager to have the structure built, Albers adds. "It seems that casino owners are always in a hurry. For that reason, we use precast concrete construction quite often because of the shorter construction schedule." That also was the case at River Rock Casino, says Giles. "It can be difficult to construct these projects quickly," he says. "But with precast concrete, you can be working on components during site preparation. Once the product gets to the site, it goes up very quickly."

In addition to the function-specific challenges, designers also must deal with the sheer size of these structures. "Casinos typically have larger parking structures, between 2000 and 8000 spaces," says Albers. "With that size, auto-flow issues become very important. Sloped parking bays may not have the traffic-carrying capacity. Ideally, casino-customer parking will be on flat floors." Wayfinding issues also become more important, to ensure that visitors can find stair/elevator towers quickly and relocate their cars on returning. To aid that, vehicle-circulation systems are held far from pedestrian destinations to minimize interaction between vehicles and pedestrians and improve safety.

The ability to meet these challenges and add other benefits is leading designers to total-precast concrete structures. "In the Mid-Atlantic region, precast concrete is the most cost-competitive structural system, because it provides the durability requirements for parking structures and it has a shorter construction schedule," says Albers. "Most casino owners are aware of precast concrete, as it is the most prevalent system. Occasionally, a new casino owner will need to be educated about the schedule, cost, durability, and quality or variety of finishes that precast concrete can provide."

Bally Caesar's Challenges

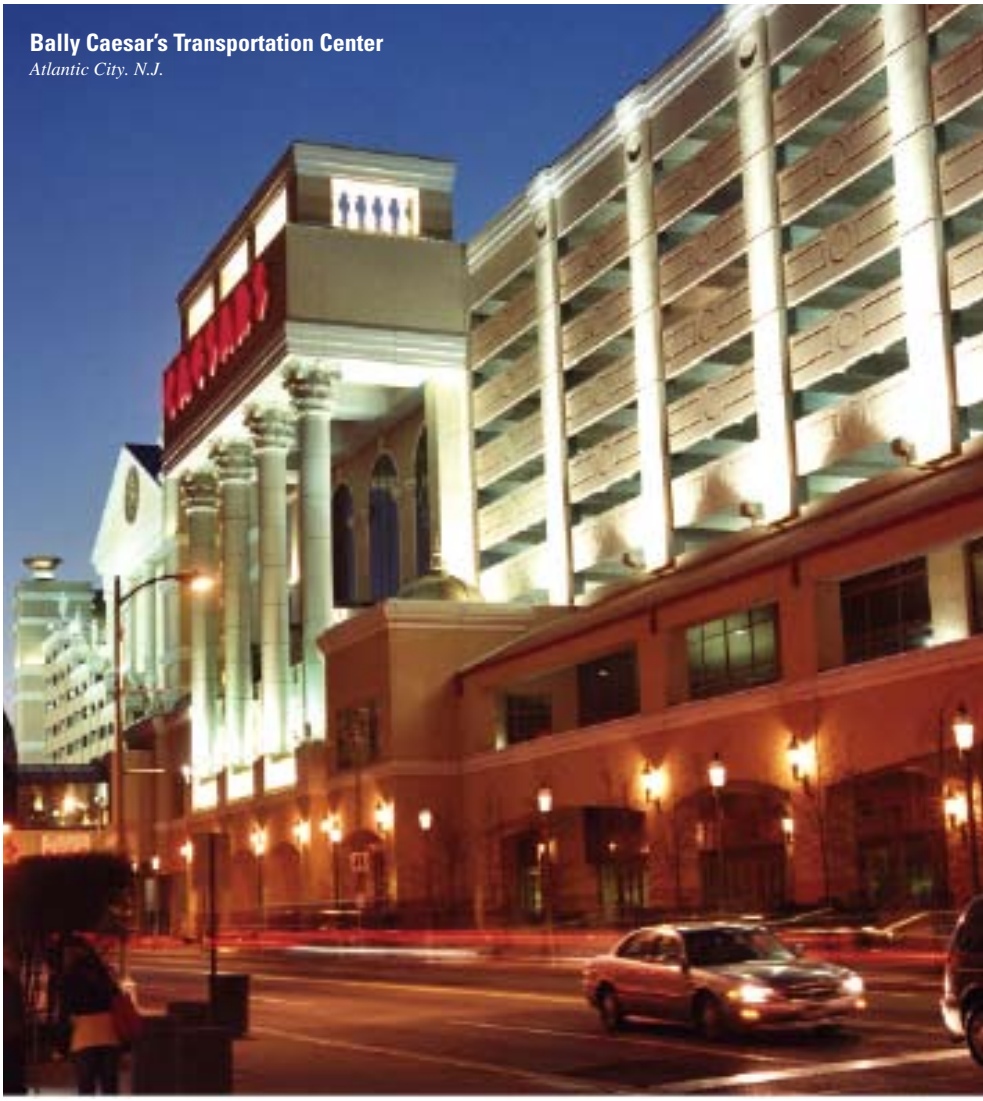
Using a precast concrete structure for the 10-level, 3234-car Bally Caesar's facility was not without its challenges, Albers notes. The structure had to accommodate the potential for a 33-story hotel tower to be built atop it. "Normally, we would plan on using cast-in-place, short-span construction for the portion under the hotel tower," he explains. "After careful consideration, we used precast concrete for several reasons."

By using long-span (15 ft × 60 ft) precast concrete double tees for the floor, parking efficiency increased 10%, while the quantity of columns was decreased, providing a more open atmosphere. Designers also specified high-strength concrete columns and shear walls, up to 14 ksi, to reduce their cross sections. This allowed parking spaces to be less affected by the vertical members' big cross sections, Albers explains. It also helped reduce member weights, keeping them below a 90,000 lb limit to aid handling.

"Future differential settlement when the hotel is erected was more easily accommodated with precast concrete," he says. "The hotel will cover a small portion of the garage's footprint." Field-topped double tees were used directly under the hotel to ensure that diaphragm loads were distributed to the shear walls.

Precast concrete's durability was a key ingredient in meeting the owner's needs, he notes. "With the ocean nearby, the structure is always exposed to salt air. Designing for durability was important. But we didn't have to take any special precautions beyond our normal design details. We typically provide additional reinforcement at key locations and use galvanized, exposed-steel, stainless-steel connectors, and epoxy-coated reinforcement in vulnerable areas." Silica fume was added to the concrete to provide additional strength in certain members, he notes. "The decreased permeability of the concrete in those cases was a side benefit."

The use of precast concrete spandrel panels on the exterior facade allowed SOSH Architects to incorporate ornate design elements, Albers adds. "SOSH used precast concrete as a foundation on which to superim-



Bally Caesar's Transportation Center
Atlantic City, N.J.

pose other finishing technologies that added an extra level of Romanesque expression. Only the addition of chariot-sized parking spaces would make it more authentic." Reveals were cast into the facade panels, and the panels were painted once they were in place. High Concrete Structures Inc. in Denver, Pa., supplied the precast concrete components.

Two cranes were used during the erection, working parallel to each other. This approach cut construction time to nine months, saving nearly 40% over the 15 months required for only one crew. Erection started at the end by the future hotel and progressed across the footprint, with the cranes staying in the parking-bay drive aisles.

The project was topped out with Romanesque pavement markings and a trellis over some of the parking spaces. This was used in lieu of landscaping on the roof, which is a requirement in Atlantic City.

River Rock Handles Slope

Across the country, unique site challenges were met with three connected but separate precast concrete parking structures at the River Rock Casino site. The project is located on a steep slope overlooking the vineyards of the Alexander Valley in California. "The structural requirements of this facility were extreme," says Giles. "The project site is an active slide plane located a few miles from a major fault line." To stabilize the soil, a complex series of soldier piles and tiebacks was created.

At the same time, the sloping site provided one benefit: the structure was divided into three segments, allowing it to follow the slope, providing grade-level access on each floor. Thus, no internal ramps were required. The structure also features substantial landscaping and a green roof to help it blend with the surroundings.

"A great deal of work had to be accomplished on a short time frame," says Giles. "We at first thought cast-in-place concrete would provide the best approach, because we could get the casting started faster. But precast concrete allowed us to make up any lost time down the road during the construction phase and complete the project quicker."

To speed the design phase, the designer brought in two precasters to work out details. "We worked side by side with them both to develop specific designs," he says. "By the time we finished construction documents, they had all the shop drawings and tickets completed so the project could go to fabrication. It eliminated a significant amount of time after the construction-document phase was completed. It also significantly reduced the costs from change orders due to lack of information, short bidding time, and other issues encountered in the traditional bidding process." Between four and five months was saved with this process, he estimates.

The design process was separated from bidding, with each precaster able to bid its own documents along with its own shop drawings, being paid a fee for the design process. Hanson Structural Precast Pacific in Irwindale, Calif., supplied the precast concrete components, which were supplemented by cast-in-place concrete drag beams, shear walls, and diaphragms to form the structural system.

The need for conventional wood forming of the cast-in-place drag beams was eliminated by incorporating the forming system into the precast concrete elements. Inward-facing, back-to-back precast L-girders provided a trough for the drag beams at interior locations while simultaneously providing bearing for the double tees, explains Kevin Boyle, project manager for Hanson. Drag beams were required extensively to collect seismic forces and drag them back into the shear walls. An inward-facing L-girder, in conjunction with a spandrel panel with an inward-facing ledge, formed the trough at perimeter locations, again providing bearing for the double tees.

Forming for the drag beams parallel to the double tees at interior locations was accomplished by providing a 2-in.-thick precast concrete slab bearing on angles welded to embed plates in the double-tee stems. The double tees were supported by rectangular girders running along the face of the concrete shear walls. "This not only reduced construction time but allowed the shear walls to be constructed continuously level to level, uninterrupted by precast components," Boyle explains.

Precast concrete columns adjacent to shear walls were designed as boundary elements. Heavily reinforced, they included a wide-flange steel section cast into each column's

Using two crews and a total-precast concrete system to construct the new 1.1 million ft² parking structure at Bally Caesar's Casino in Atlantic City, N.J., cut construction time by about 40%.

Fact Sheet

Project: *Bally Caesar's Transportation Center*

Type: *Casino parking structure*

Location: *Atlantic City, N.J.*

Designer: *SOSH Architects, Atlantic City*

Engineer: *Walker Parking Consultants, Wayne, Pa.*

Contractor: *Massett/Bertino, Atlantic City*

Owner: *Bally Corp, Atlantic City*

PCI-Certified Precaster: *High Concrete Structures, Denver, Pa.*

Size: *1 million ft²*

Precast Concrete Components: *116 beams, 213 haunched columns, 367 spandrel panels, stairs, 1128 wall panels, 1273 double tees, 407 girders*

Project Cost: *$80 million (including connecting bridges)*

Because the parking structure offers multiple entry/exit points, the designers incorporated a precast concrete flyover bridge from the main connector road. The precast concrete vehicular bridge spans a city street and is located adjacent to an existing garage.

'Designing for durability was important.'

The architect used precast concrete as a foundation on which to superimpose other finishing technologies, adding an extra level of Romanesque expression.

Precasters constructed the double-helix ramp at the center of the structure by creating custom forms that turned and sloped in precise configurations.

The designers and precaster agreed that the double-helix ramp should be built with precast concrete to avoid bringing scaffolding and other trades into the facility as it was being erected.

The Greektown Casino in Detroit, Mich., features a total-precast concrete structural system that had to be modified as construction began when the owners decided to add a hotel onto a corner of the site.

base to provide erection stability of the columns while allowing the main reinforcement of the columns to pass into the void for the pile caps. The pile caps and columns became monolithic once concrete was placed. Embedded couplers with reinforcing-bar dowels tied the column to the shear walls.

Exterior planters decorate the structure. They were supported by outriggers on the precast concrete columns and were cast monolithically with the columns. "Exacting tolerances were required due to the prominent nature of the fascia panels and planters," Boyle says. Walkway precast concrete columns supporting planters at grade level were cast with embedded nooks for light fixtures.

Throughout construction, the casino remained open, with access for trucks and erection equipment provided along a narrow, winding road up a steep grade. Precast concrete deliveries had to accommodate casino patrons' cars and charter buses, which traveled the same route. Crane access was also limited, requiring the use of a crawler crane due to product weight and reaches.

"We met on a weekly basis over four months to develop the details and answer questions," says Giles. "It was a very collaborative design effort. It was a difficult site, and we had a constant line of trucks coming in and going out, but the staging of trucks went very smoothly. There were no problems with delivery or erection."

Greektown's Tight Site

A tight site also was a key challenge for the Greektown Casino in Detroit. The project was made more difficult when, as construction began, owners were unable to secure the nearby site planned for a hotel and decided to include it on a corner of the lot originally planned for the parking structure. That required reconfiguring the parking facility into an L shape, with new levels added. Parking extends into the adjacent hotel building on seven mid-level floors of the 22-story hotel.

"The design for the parking structure was planned to be totally precast concrete right from the start," says Jobin. "The overriding reason was cost, plus the timing of the construction." Erection of components for the 13-story project began at the edge of the hotel's footprint and worked away from it to ensure that construction would not be under way on both projects in the same area once the hotel project began.

The parking facility opened last November, while the hotel will open in February. Both serve the nearby casino. "The casino needed parking desperately," says Jobin. The project is located in the middle of the Greektown area of Detroit, surrounded by a freeway (which provides easy access), a juvenile justice center, and two large, Greek Revival–style churches. The tight site played to precast concrete's strengths of easily maneuvering in tight spaces and eliminating congestion from the site.

The project took 13 months to construct and features an innovative double-helix ramp constructed from precast concrete. "The double-helix design was the only one that made sense from a functional standpoint," Jobin says. "Our assumption was that it would be a post-tensioned, cast-in-place concrete design, due to the tight curves and contours."

But National Precast in Roseville, Mich., pointed out that erecting scaffolding and formwork during precast concrete erection would cause delays. Rich & Associates checked with the other precaster bidding the project, and it agreed it could build the ramp. National won the bid and went to work. "They rolled up their sleeves and did the up-front engineering on their own to ensure the feasibility," Jobin says. "We based our design

The Greektown casino features inset brick in a blended red and buff color to complement neighboring buildings.

Fact Sheet

Project: *Greektown Casino Parking Structure*

Type: *Casino parking structure*

Location: *Detroit, Mich.*

Designer/Engineer: *Rich & Associates, Southfield, Mich.*

Construction Manager: *Jenkins/Skanska joint venture, Detroit*

Owner: *Greektown Casino LLC, Detroit*

PCI-Certified Precaster: *National Precast, Roseville, Mich.*

Size: *1 million ft²*

Precast Concrete Components: *1400 pretopped double tees, 400 architectural panels, 548 ramp panels, 1119 various structural components (including columns, beams, litewalls, and shear walls)*

Project Cost: *$27 million*

'The design for the parking structure was planned to be totally precast concrete right from the start.'

drawings on their early input."

Neither precaster nor architect had ever constructed a precast concrete double-helix ramp, he notes. "It very much was a leap of faith. But we saw in the drawings they produced that they could accomplish it."

It wasn't an easy process, says Norm Presello, senior project manager. "We just took the bull by the horns and said it had to be done in precast concrete, because we couldn't have another trade pouring and forming concrete at the center of the structure while we were erecting it."

The company scoured the country to find qualified engineers to detail the drawings and individual pieces. "We got turned down by everyone over three months' time, and finally decided to do it ourselves," he says. Likewise, no one was willing to build the forms, so National had its own shop welders and detailers create them.

Seven slab forms and four curved spandrel forms were created, each with its own curve, skew, and slope to meet the requirements of the turning, sloping ramp design. The driving surface featured slopes of anywhere between 0 and 12%, Presello notes, and they changed as the ramp turned through its rising curve. The slabs served as the formwork for the ramp's concrete topping, eliminating the need for forming and saving more time, he adds.

Because of the structure's height, columns were cast 3 ft × 4 ft, twice the typical size for structural columns. Shear walls were likewise cast 18 in. thick at the main bearing walls, using 8000 psi, self-consolidating concrete.

The parking structure sits directly adjacent to the hotel, with parking spaces continuing on levels 7 to 13 of the hotel structure itself, providing an additional 30 spaces per floor. Below these levels, hotel function rooms were provided, while hotel rooms start above the parking levels.

The facade features inset brick in a blended red and buff color to complement the neighboring buildings. Spandrel panels feature both a buff finish with local limestone aggregate and a rusty red pigment achieved with red granite and red sand.

The precast concrete double helix was a testament to the close cooperation between designer and precaster, as well as their belief in their abilities. "This shows that almost anything can be created in precast concrete," Presello says. "It was a very complicated configuration, but by doing it this way, we could accelerate the construction schedule significantly."

The words "accelerated construction schedule" are music to the ears of casino owners. With casinos' popularity only increasing, more parking facilities will be needed, and precast concrete designs will continue to push the envelope to meet the challenges they present. ■

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