

Precaster plays **central role** in design of **rooftop garden**

Sue McCraven

This picture of the rooftop garden above the 909 Walnut Street Parking Structure in Kansas City, Mo., illustrates the compact site. In addition to constructing the parking structure in these most restrictive site conditions, the project team had to work with an old, existing foundation. **Courtesy of Dennis Befeler and Dirk McClure of IPC Inc.**



John Tanner and Monty Overstreet
discuss structural design at the
FDG Inc. offices in Arvada, Colo.
Courtesy of FDG Inc.



The judges of PCI's 2007 Design Awards Competition were clear why the 909 Walnut Street Parking Structure rooftop garden in Kansas City, Mo., received the award for Best Sustainable Design.

"This seven-story parking structure, especially with the inclusion of its garden roof, provides an excellent example of a sustainable precast concrete system," the judges said. "The 8 ft double tees were innovative in being specially designed to accommodate full-grown trees and other large loads that most such projects would not have to support. The use of regional materials and recycled content, as well as the design approach to reduce water runoff and heat-island effect, led to an excellent sustainable design that should serve as an example for other such projects."

Team members

Architect:

Stott & Associates Architects P.A. of Ames, Iowa

Specialty engineer and engineer of record:

FDG Inc. of Arvada, Colo.

Owner:

Simbol Commercial of Dallas, Tex.

General contractor:

The Weitz Company of Overland Park, Kans.

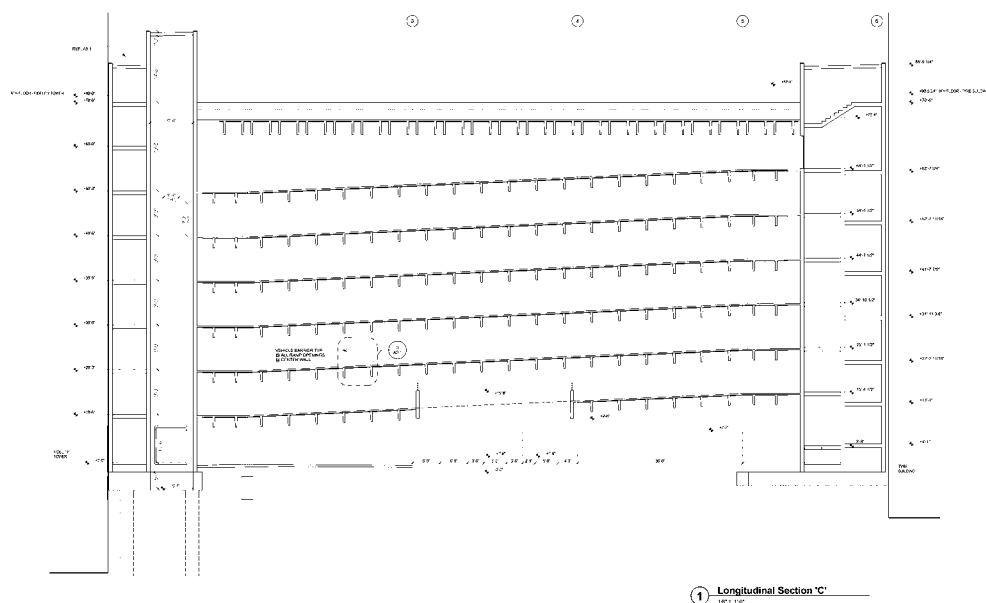
Precaster:

IPC Inc. of Des Moines, Iowa

Four years ago, when plans for the 909 Walnut Street Parking Structure were initiated by the owner, Glenn Solomon of Simbol Commercial of Dallas, Tex., his goal was to provide a landscaped outdoor setting for adjacent condominium owners and their pets. This rooftop garden amenity for building residents has earned significant praise and exposure as an outstanding sustainable, total-precast concrete design.

"We are proud that the rooftop garden has proved to be a great amenity for residents," Solomon says, "and is a perfect application of the movement to make urban areas more green."

Sue McCraven interviewed John Tanner, P.E., senior engineer with FDG Inc., project specialty engineers of Arvada, Colo., who explains the collaboration and precast concrete design for this award-winning rooftop garden.



Project: 909 Walnut Street Parking Structure
Location: 909 Walnut Street, Overland Park, MO 66214
Client: City of Overland Park
Architect: Stott & Associates Architects P.C.
Engineer: Stott & Associates Architects P.C.
Date: 10/20/07
Sheet: A6.3

Project: Open Parking Garage
Location: 909 Walnut Street, Overland Park, MO 66214
Client: City of Overland Park
Architect: Stott & Associates Architects P.C.
Engineer: Stott & Associates Architects P.C.
Date: 10/20/07
Sheet: A6.3

SM: Can you explain the differences between a typical precast concrete parking structure design and one that supports a rooftop garden?

JT: A great deal of planning went into making this green roof possible because of the increased loading of the roof's landscape elements. A typical parking structure is designed for minimal superimposed dead load and a 40 lb/ft² to 50 lb/ft² (200 kg/m² to 240 kg/m²) live load. The rooftop garden area for the 909 Walnut Street Parking Structure was designed for a superimposed dead load of 150 lb/ft² (730 kg/m²) and a live load of 100 lb/ft² (490 kg/m²). This represents a significant increase in the design live loading over that of a typical project.

For parking structures with spans of about 60 ft (18 m), this requires deeper precast concrete members. In this project, we used specially designed 36 in. (910 mm) double-tee beams with the flanges narrowed from 10 ft (3 m) to 6 ft (1.8 m) wide.

SM: How much more can an owner expect to spend to develop a rooftop garden?

JT: An owner would probably tell you that the landscaping design, depending on how elaborate it is, can present a significant cost factor. The actual structural costs, however, are nominal.

It is generally the number of required pieces that affects the structural cost the most. The precast concrete members on the 909 Walnut Street Parking Structure roof were deeper and narrower, requiring more pieces. With the double tees designed only 6 ft (1.8 m) wide instead of 10 ft (3 m) wide and spaced at 10 ft intervals, the total number of double-tee beams required for the roof was a 67% increase over the pieces needed for the lower levels.

This section drawing through the levels of the 909 Walnut Street Parking Structure in Kansas City, Mo., clearly shows the greater number of modified precast concrete double-tee beams used to support the increased loading of the rooftop garden. *Courtesy of Stott & Associates Architects PC.*

Site restrictions included zero-lot-line buildings at either end of the site and an elevated alley in the back, so we designed this structure to fit precisely. The existing building that was demolished was actually embedded into an adjacent structure. It was the existing foundation, however, that proved most problematic during construction. The old foundation affected the design of the drainage system and location for new foundation elements.

The project team worked in concert to move directly from the concept drawings to actual working documents, including shop drawings, for the fabrication of the precast concrete elements. The three-dimensional documents provided by FDG served dual functions as both the structural and shop drawing for the precaster, IPC Inc. of Des Moines, Iowa. This saved substantial time.

Mike Slotter, AIA, of Stott & Associates Architects, who worked with both the project architects and the precaster, was well versed in the use of precast concrete. While the owner and general contractor were busy with the construction of the condominium tower, the design team worked together to solve issues the same day they arose. These included drainage systems, waterproofing methods, access to the garden, and strategic locations for the heavy planters. The internet and sharing of electronic documents worked very well.

SM: What has been your experience in using precast concrete for green construction?

JT: While our precast partner, IPC, has been involved in several LEED-certified structures (including the platinum LEED-certified Alberici Headquarters in St. Louis, Mo.), it has not been until the past few years that FDG has been involved in LEED or green projects.

Construction was possible from only one side of the 909 Walnut Street Parking Structure. The structure is sandwiched between existing older buildings in downtown Kansas City, Mo. Courtesy of Dirk McClure of IPC Inc.





A 16,000 ft² (1500 m²) rooftop garden, the largest elevated garden in Kansas City, Mo., gracing the top of the seven-level 909 Walnut Street Parking Structure, won PCI's 2007 Sustainable Design Award. *Courtesy of Simbol Commercial.*

As specialty engineers, our focus has been limited to the precast concrete elements and their contribution to LEED points. FDG's experience has shown that precast concrete has some inherent properties that are advantageous in developing LEED projects.

In the case of the 909 Walnut Street Parking Structure, the sustainable attributes included a reduced heat-island effect (roof and non-roof), reduced water runoff due to the roof vegetation, 5% recycled content, regional materials (100% manufactured regionally and 95% extracted regionally), innovative design, and minimal site disturbance.

The reduced heat-island effect, use of regional materials, and minimal site disturbance are typical attributes for most precast concrete projects. For the precaster, adding recycled materials such as fly ash is relatively easy to incorporate into production.

SM: Is LEED certification fairly easy to obtain?

JT: If the 909 Walnut Street Parking Structure had been a full LEED project, more up-front collaboration with the architect, precaster, and all other team members would have been required. The ease or difficulty in obtaining LEED certification depends mostly on the experience level. As architects, engineers, and contractors get more experience in green construction, the process and time frame will improve greatly.

Sustainable precast concrete structures provide value to the owner/developer, the end user, and to the community as a whole. In the case of the 909 Walnut Street

Parking Structure, the condominium owner clearly understood the economic incentive that the roof garden presented in marketing to potential buyers.

In addition, the rooftop garden adds a little bit of Mother Nature to downtown Kansas City. The up-front investment in green construction translates into long-term economic and quality-of-life benefits, making sustainable design and construction a smart choice for all concerned.

SM: Do you have any advice for engineers, specifiers, or precasters who are interested in building rooftop gardens?

JT: Concentrate on early planning, collaboration, and limiting the superimposed dead loads with lightweight fill materials. The geo-foam products used in the parking structure were 3 ft (0.9 m) to 5 ft (1.5 m) deep so that the actual soil needed was only 6 in. (150 mm) to 8 in. (200 mm) deep. The geo-foam was removed in isolated areas for planters with soil depths of 3 ft (0.9 m) or 4 ft (1.2 m). Effective drainage must be an early consideration. The entire Walnut Street Parking Structure was sloped to one side to allow for good drainage.

SM: How big a role does an experienced precaster play in developing a project like this?

JT: IPC's role was central to making this project so successful. The initial development of this project was promoted by the precaster and the project architects. They developed the initial sketches and plans to enable the owner and his general contractor to establish an accurate budget in determining the feasibility of the project.

Prior to our full team's involvement, the project was initially designed as a cast-in-place concrete structure but was not able to meet either the budget or the aggressive schedule requirements. By changing the design to an all-precast concrete structure, we were able to meet the schedule, save the project about 25% of the cost, and provide the additional loading and all of the other special project requirements. The use of precast, prestressed concrete was pivotal in the success of the 909 Walnut Street Parking Structure.

About the author



Sue McCraven is an engineer, freelance writer, and editor in Farmington Hills, Mich. She has worked as the engineering editor of the *PCI Journal* since 2002.

Synopsis

The 909 Walnut Street Parking Structure in Kansas City, Mo., received PCI's Best Sustainable Design award in 2007. John Tanner, P.E., senior engineer with FDG Inc., project specialty engineers of Arvada, Colo., discusses the challenges of building a parking structure that supports a rooftop garden.

Keywords

Green roofs, LEED, loading, parking structures, rooftop gardens, sustainability.

Reader comments

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