CASE STUDIES

DESIGNING FOR THE FUTURE

PROJECTS DEMONSTRATE PRECAST CONCRETE'S STRIDES IN SUSTAINABILITY

BY MONICA SCHULTES AND DEBORAH R. HUSO

Limestone Bluffs

Since the 1880s, the industrial development of Kansas City was closely related to the limestone that was quarried and mined in and around the city. Extensive mining operations left a distinctive exposed face and created ledges and formations. In Kansas City's early days, the limestone bluffs towered above the riverfront buildings; now the precast concrete panels incorporate multiple layers in a modern interpretation.

Scranton recalls that the local limestone bluffs were inspirations to the design aesthetic of the skin of the processing building. There is a contrast between the coarse limestone reference cladding the warehouse and the smooth, polished limestone that clads the adjacent landmark post office.

Random Repetition

According to Enterprise Precast Concrete's director of business development Dirk McClure, two different finishes were used within each panel. "One of the most notable aspects of the architectural precast concrete on this project is the utilization of raised layers of acid-etched finish and recessed layers with a retarded finish. The same mix design incorporates these two different finishes, but on different planes. The precast façade simulates the rock formations seen in both the natural landscape as well as the prominent limestone buildings downtown."

A frequent challenge to the precast concrete manufacturer is how to achieve the design concept of a random pattern while optimizing repetitiveness for operational and cost efficiencies. "If we built individual forms for every single piece, it would be cost prohibitive," explains McClure. "With a few long custom wood forms, we selectively laid out the individual panels using different portions of the same forms to give the appearance of complete randomness—but in reality, we incorporated some repetitive efficiency into our production process."

LEED-Certified

Scranton recalls that designing for LEED certification 20 years ago was vastly different. "Today we calculate embodied carbon and review EPDs [environmental product declarations]. We might have opted to reduce cement in the concrete mix design." While the calculations may have changed, the precast concrete is designed for the long haul.

At the time, LEED v2.2 enabled precast concrete to contribute local and regional materials from within 500 miles of the jobsite. With its off-site modular production, precast concrete helped minimize construction waste management and reduced the number of trades on-site. Its inherent resiliency enables it to withstand vermin, fire, storm, or flood damage.

The General Services Administration and IRS aim to ensure the long-term durability, maintainability, and efficiency of new or renovated facilities. The costs of operation and maintenance are considered as part of their plans for design excellence. The IRS building in Kansas City has aged gracefully and continues to be an inspiration for a highly efficient and sustainable government facility and serves as a model for future projects.

RESEARCH DRIVE PARKING GARAGE AT DUKE UNIVERSITY

DURHAM, N.C. /// *BY DEBORAH R. HUSO*

Duke University in Durham, N.C., has long had a commitment to sustainability: More than 50 campus buildings are LEED-certified. Completed in 2010, the Research Drive Parking Garage at Duke University has been a surprising standout for longevity, demonstrating a still rare quest for sustainability in a parking facility. The building celebrates 15 years of service to the Duke community this year.

When several new building projects in the research zone of the campus eliminated surface parking and necessitated the construction of a new parking facility, the university set out to build a sustainable structure that would integrate with the campus' existing architecture. The seven-story, 1917-space, stand-alone, single-use parking structure is certified by the USGBC, earning 31 LEED points.

"When we were designing the garage with sustainable goals in mind, it was important to design for durability and the life cycle of the structure overall," says Todd Lohman, senior vice president with Indianapolis, Ind.–based Walker Parking Consultants. "What was really unique about this [structure] was the aesthetic: Duke wanted it to be traditional and incorporate Duke stone and some terra cotta, and we needed a complementary material. That turned out to be precast concrete."

An exterior express ramp on one side of Duke University's Research Drive Parking Garage allowed all the floor plates to be flat, providing passive security with unobstructed internal views. ***Photo:*** *Ratio.*

Designing for LEED Certification

Sustainable green design was a goal from the beginning. "A lot of people think of parking garages as a negative," says Jeff Milliken, principal with Indianapolis-based RATIO Design. "There's the connotation that cars are bad, but we set out to design a really sustainable parking garage."

"There had not been a stand-alone parking garage that got LEED certified," adds Milliken. And to this day, it's the one and only LEED-certified parking structure in the country.

While the parking structure was cast in place, precast concrete accounts for most of its architectural façade. "We used multiple other materials to scale [the building down]," says Milliken. These include locally quarried Duke stone, glazing on the towers, and a greenwall.

Addressing a Challenging Building Site with Precast Concrete

Because the Duke University campus environment has a lot of pedestrians and traffic, precast concrete offered a simplified construction solution for the parking structure's façade. All components were made in a factory setting and delivered to the jobsite for erection.

The mixture of precast concrete spandrel panels at the upper levels and the terra cotta and stone material at the lower levels provides a unique design solution to give the façade a variety of textures and colors that visually reduces the scale of the parking structure. The precast concrete column covers provide a vertical element to the façades while concealing cast-in-place concrete columns.

PROJECT SPOTLIGHT
RESEARCH DRIVE PARKING GARAGE AT DUKE UNIVERSITY

- Location: Durham, N.C.
- Size: 694,269 ft^2
- Cost: $35 million
- Architect: RATIO Design, Indianapolis, Ind.
- Owner: Duke University, Durham, N.C.
- Contractor: Bovis Lend Lease Inc., Durham, N.C.
- Structural Engineer: Walker Parking Consultants, Indianapolis, Ind.
- PCI-Certified Precast Concrete Producer: GATE Precast, Jacksonville, Fla.
- Precast Concrete Components: 871 precast concrete pieces

One of the biggest design and manufacturing challenges of the parking structure's architectural precast concrete panels was to blend with the campus architecture using a complementary material palette and patterned façade that resembles the fenestrations on existing campus structures.
Photo: *Ratio.*

PRECAST CONCRETE HELPS PARKING STRUCTURE GAIN HONORS

Duke University has been committed to sustainable building standards since 1993, and its construction of a new parking structure in 2010 did not deviate from that commitment. Clad in architectural precast concrete, the Research Drive Parking Garage not only achieved LEED certification but also demonstrated a wide array of design and construction benefits of precast concrete:

- Fast construction timeline
- Reduced construction activity on an already tight building site
- Reduced carbon footprint
- Ease of architectural integration with existing campus structures
- Long-term, low-maintenance durability

One of the biggest design and manufacturing challenges of the structure's architectural precast concrete panels was to blend with the campus architecture using a complementary material palette and patterned façade that resembles the fenestrations on existing campus structures. This required detailing of the deep precast concrete column cover returns as well as reveals and exterior panels at the edge of the roof trellis planter boxes. The depth of the precast concrete covers that hide the building's concrete structural columns gives the exterior a sculptural appearance. Precast concrete panels and column covers also provide a "punched opening" rhythm to further complement the designs of adjacent university structures.

The façade features a warm melding of colors and textures, including a smooth monolithic finish made with a red stone aggregate that complements the locally quarried Duke stone used in the façade. The neutral color of the precast concrete also contributes to a reduced heat-island effect.

"The campus has some topography to it, so the site itself was multilevel," says Milliken. That meant vehicles could enter the parking structure at two different levels. An exterior express ramp on one side of the structure allowed all the floor plates to be flat, providing passive security with unobstructed internal views. The structure also features a high level of service lighting along with painting of the undersides of the concrete structure to provide maximum visibility.

Parking Structure Makes the Grade

The use of regional materials, including precast concrete components manufactured only 25 miles away from the jobsite, contributed to a low carbon footprint during construction and helped add LEED points for the project.

Also contributing to the project's LEED certification were site credits for removal of surface parking lots, the structure's connectivity to mass transit, use of recycled steel in the structural frame, reforestation of 75% of the building site with native plants and trees, and a roof outfitted with photovoltaics to provide power to the parking structure and other campus structures. Precast concrete wasn't the only locally sourced material. The Duke stone used to accent the parking structure tours was quarried locally. "It became a garage of multiple materials that really complemented each other," Lohman says. "We liked that it was durable. All you may have to ever do is clean it."

"We kicked the door open on getting this garage LEED certified," he adds. "We insulated support spaces and met energy codes that were new. We were one of the first to incorporate LED lighting."

Lohman says Duke University wanted a high-quality structure that was architecturally attractive. "That's easier to achieve with precast concrete," he says. "Hopefully this garage will be timeless for how it serves users, how it looks, and its sustainable features. It's an iconic project for buildings of this type."

A major benefit of using precast concrete is its long-term durability. "With proper maintenance, this structure will be usable for 50 years and beyond," says Travis Fox, vice president of sales for GATE Precast, the precast concrete producer for the project.

In July 2024, GATE Precast joined Wells, expanding the national footprint.