By Roy Diez

SLAYING THE MYTHICAL DRAGON

Duke University proves that green parking garages are more than fairy tales.

A sustainable parking garage? LEED certified? Conventional wisdom said it couldn't be done, but conventional wisdom was wrong.

Committed to completing construction projects in a manner that is as environmentally sustainable as possible, Duke University in Raleigh-Durham, N.C., made a conscious decision to attempt LEED certification for its new parking garage. "The choice to attempt LEED certification," summarizes the original Owner's Project Requirements statement, "promotes the University's philosophy on sustainability to the project team and benefits the end user and the environment."

Located in the research zone of the Duke campus and adjacent to a medical clinic, the structure's users include students, faculty, patients, and visitors. Each targeted group has its own floors and entry/exit locations in the garage, and the seven-level, 690,000-square-foot structure offers 1,917 parking spaces.

The Duke University Research Drive Parking Garage became the first LEED-certified, single-use, stand-alone parking garage in the nation. Before this groundbreaking approach to sustainable parking design, designers had secured LEED status for garage projects only by physically linking them to traditional construction projects with occupied space or by incorporating mixed-use components (such as commercial or retail space) that feature non-parking-related green design elements that score high on the U.S. Green Building Council's (USGBC's) certification criteria.

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"Accepted practice had been that a garage could not be certified because it did not have occupied space," said Todd Lohman, P.E., managing principal for the Indianapolis office of Walker Parking Consultants. "But, we did it." The Duke parking structure earned 31 LEED-NC 2.2 points from the USGBC.

A Ban on Garages

Duke's garage was certified before the LEED ruling that now prohibits parking garages from LEED certification (see sidebar).

Despite the new rule interpretation, Lohman insists that parking structures can and should work to provide sustainability features.

"You can still design sustainably without submitting a score sheet," he says. "A lot of jurisdictions, states, and municipalities are going to certification independent of USGBC. The reality is that parking garages are going to be continued to be designed and built and we should do that sustainably, whether it's part of a LEED process or something else."

The Duke garage offers a blueprint for designing and building environmentally-friendly parking structures. The project earned credits in all six LEED categories and even features green walls and roof systems.

The structure's functional design takes advantage of its host topography. Level floor plates are serviced by an exterior express ramp on one side. This design, coupled with white paint on the undersides of the concrete slabs, provides enhanced light reflectivity, unobstructed internal views, and enhanced security. Beam sides and bottoms are painted to match the exterior façades. Entry/exit locations on the ground level are for students, staff, and faculty. The second level is dedicated to visitors, primarily those to an adjacent eye center, and has its own entry/exit.

Architectural precast concrete spandrel panels clad the upper-level façade of the garage. Column covers are also made of precast concrete and exterior precast panels define the edge of the roof trellis planter boxes. "Duke stone" (the university has its own stone quarry) is at the base, and terra cotta wall tiles are featured on the exterior of the lower levels and stair towers to provide a variety of textures and colors and reduce the perceived scale of the building.

Durable materials, such as precast concrete, were chosen to provide a long service life for the structure.

A total of 871 precast panels were used. Typical panels measure 30 by 7 feet. The large panel sizes allowed the structure to be enclosed quickly, which was critical to the schedule. This allowed the owner to take possession of the deck sooner. (Like the Duke project, all of the sustainable garages listed in the accompanying sidebar used precast concrete construction.)

The garage blends well with the existing campus architecture. The color of the precast wall panels and their "punched opening" rhythm matches the design of surrounding buildings. The façade provides a monolithic look at a distance, but red stone aggregate in the precast panels lends color close up. Column covers provide a vertical element and a sculptural appearance to the façades while concealing the concrete columns. Reveals in the precast give the project a more human scale and align with curtain-wall mullions and tile joints.

Planted trellis wall panels further soften the appearance at the entrances. Plants are attached to a screen that's secured to the walls. The project also includes rooftop canopies or shade structures made of metal mesh on top of steel framing. Vines grow up wires from planters and filter into the mesh. The canopies reduce the building's heat island effect and the attached greenery helps alleviate heat reflection and reduce daytime heating of the structure. Irrigation is provided by two on-site cisterns that collect and filter storm water from the garage's top level. Storm water overflow is directed to bio-retention basins, treated, and infiltrated naturally.

"The biggest design challenge was creating an appropriate functional design and architectural character while meeting LEED requirements," says Lohman. "It was decided very early in the design process to include planted walls. This was done to emphasize sustainability, bring green material and architectural interest into the design, and help identify the entry/exit locations. Also, the university wanted some covered parking on the top tier. The green canopies were a unique way to bring shade to this level."

Creating a Sustainable Site

Development density, community connectivity, public transportation access, and alternative transportation LEED credits were all received by the Duke garage. The average site development density for the project and surrounding areas is 95,442 square feet per acre. The parking garage footprint was limited to be within the existing paved areas of the site. A total of 100 preferred parking spaces for low-emitting and fuel-efficient vehicles are available, and car/van

pool parking is provided for a minimum of 5.2 percent of the total parking spaces.

The site was previously developed; 50 percent or more of the site area outside the building footprint has been restored with native or adaptive planting. More than 50 percent of the site is dedicated open space. Landscaping consists of native species that require minimal or no irrigation. A total of 82 percent of the non-building area has been planted with native or adaptive species.

The project's irrigation systems use only captured rainwater. Use of low-flow water closets and ultra-low-flow lavatories in the employee restroom reduces project potable water use by 39.2 percent.

Cutting Energy Use, Using Recycled Materials

The Duke garage is designed as an open structure to minimize the need for mechanical ventilation. Energy-efficiency measures, including reduced interior lighting power density, and reduced exterior lighting, allowed the project to achieve an energy cost savings of 29.9 percent. The project also uses energy-efficient LED lighting and daylight harvesting. Photocells are used to turn off certain light figures on the floors during the day to save energy. All light fixtures are cut-off units to reduce light pollution.

The cashier station, break room, restroom, electrical room, and elevator control rooms are mechanically heated and cooled. The conditioned floor area (1,217 square feet) is serviced by packaged rooftop heat pumps. The electric air-source heat pumps feature electric auxiliary heat that only energizes when the outdoor air temperature is less than 40 degrees.

The project complies with ASHRAE Standard 62.1-2004. Ventilation is primarily based on natural open parking garage design. Fresh air intakes are included in all enclosed spaces. Programmable controls are included for lighting, HVAC, and PARCs wireless lighting control system for after-hours use, seasonal use, special events and campus-specific programs. Thermal controls are provided for the workstation and the HVAC system, and building envelopes are designed to meet ASHRAE Standard 55-2004. A thermal comfort survey was distributed.

In total, 11.8 percent of all building materials' content, by value, was manufactured using recycled materials, and 24.3 percent of all materials, by value, was extracted, harvested, recovered, or manufactured within 500 miles of the project site. All precast concrete components were locally sourced. Reinforcement in the precast is 100 percent recycled steel. All indoor adhesive and sealant products consist of low-VOC-emitting materials. The project diverted 75.6 percent of on-site generated construction waste from landfills.

Finally, educational displays in the elevator lobbies and public tours help explain the project's sustainable design to occupants and visitors.

Conventional wisdom is wrong—parking garages can absolutely be green. Duke's newest structure proves it. P

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LEED Bans Parking Garages

In May 2011, a LEED interpretation ruling determined that parking garages could no longer obtain LEED certification (See p. 8 in the August 2011 issue of *The Parking Professional*).

A number of highly sustainable—and highly visible—parking garages had been completed in the years just prior to that ruling. Several, in fact, obtained LEED certification, usually as elements of more extensive sustainable building projects, including:

- University of Florida Southwest Parking Garage, Gainesville, Fla.
- Denver Justice Center Parking Garage, Denver, Colo.
- Santa Monica Civic Center Parking Structure, Santa Monica, Calif.
- Rush University Medical Center Parking, Chicago, Ill.
- Detroit Blue Cross Blue Shield Parking Structure, Detroit, Mich.

One of the most innovative, and perhaps provocative, was the Duke University garage featured here, which received LEED certification in November 2010. It's provocative because it is a stand-along parking garage without a companion occupied structure and was widely promoted as the first-ever LEED certified single-use parking structure. The new USGBC rule interpretation came some six months later.

"We were obviously disappointed when they came out with that ruling," says Todd Lohman, P.E., of Walker Parking Consultants. "I don't know the motivation behind it. Maybe the Duke garage caught them off guard."

Stand-alone parking garages had not been deemed to meet LEED certification requirements. It's difficult for garages to measure up to the traditional components that define a sustainable structure. Credits for water use reduction techniques, high efficiency HVAC systems, and management of indoor air quality, for the most part, were considered not possible with parking garages. In addition, green building advocates have never had a love affair with the car.