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HEALTHCARE DESIGN

FEATURE

Caring for Patients and the Environment

MEDQUEST COMMUNICATIONS IN CONJUNCTION WITH THE CENTER FOR HEALTH DESIGN

The 265,000-square-foot Winship Cancer Center Institute provides clinical care for cancer patients and houses space for original basic science research. *Photo by Gary Knight + Associates.*

Caring for patients and the environment

A world-class cancer center goes green at Emory University in Atlanta

BY GREGORY R. JOHNSON, PE

Emory University has had a long history of providing quality cancer care, research, and medical training since its clinics first opened in 1937. Unfortunately, cancer remains one of the leading killers of Georgians, and Atlanta is one of the largest cities in the country without a "Comprehensive Cancer Center" as designated by the National Cancer Institute. When Emory University's Woodruff Health Sciences Center set out to change that, it realized that a new home was required to meet its potential, and the Winship Cancer Institute (WCI) project was initiated, focusing exclusively on cancer research and serving cancer patients and their families. The new WCI is a powerful tool in the fight against cancer and represents not only cutting-edge healthcare design but also leadership in sustainable design and construction.

The WCI was the first building of its type to receive a Certified Rating in the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) program. Design professionals often attempt to convince owners of the benefits of sustainable design, but selling "green" was not required at Emory. The university has a long history of environmental consciousness and has been both a leader in the acceptance of sustainable design and an early supporter of the USGBC's LEED program. The university's Whitehead Research Building, with a Silver Rating, was the 24th building in the country and the first in the Southeast to be LEED-certified.

Here, category by category, is how the WCI designers accumulated the necessary points for the LEED Silver Rating.

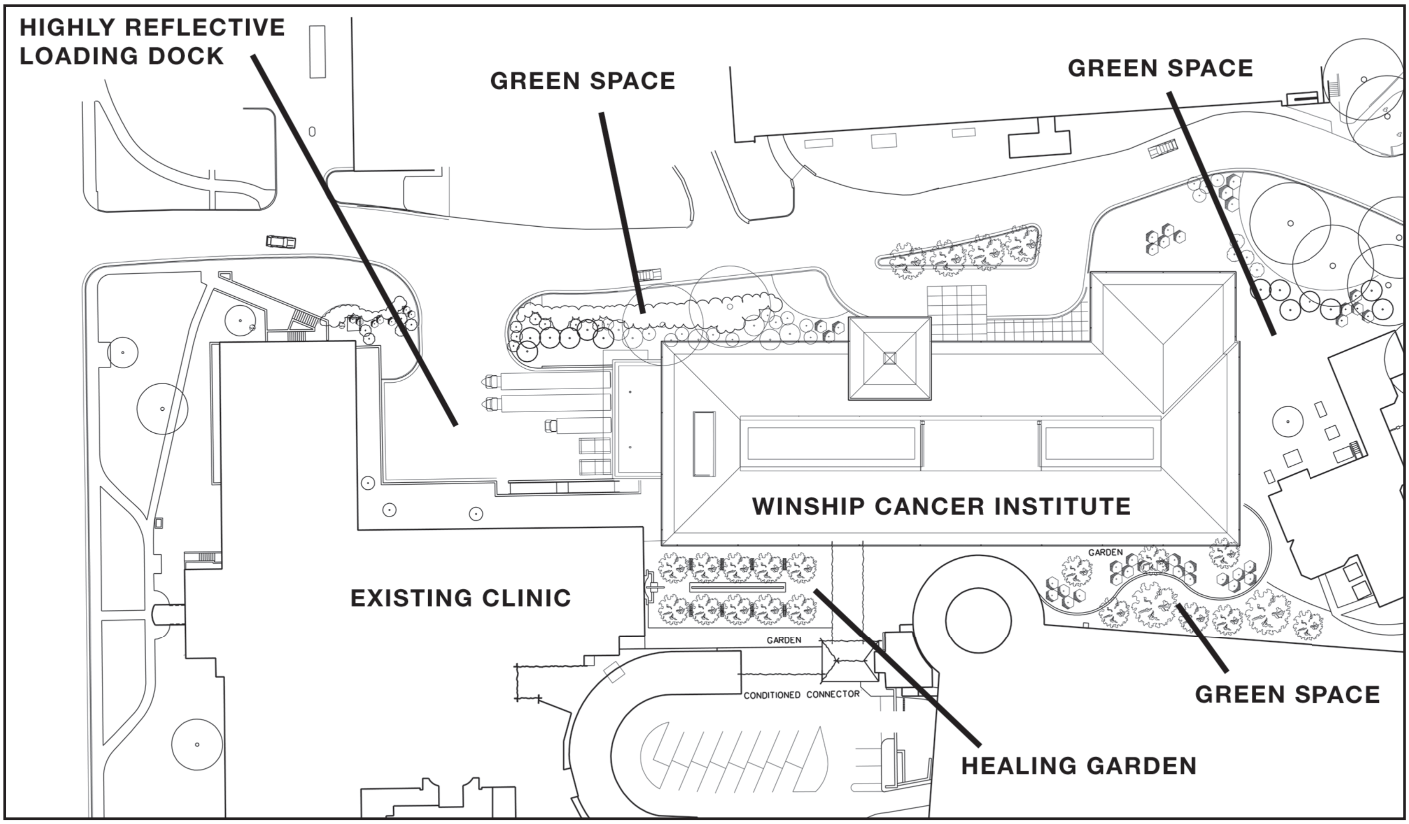

Figure 1. The site, while constrained, retains green space to the east. A healing garden integrated between structures provides a place for reflection. A highly reflective surface minimizes heat gain at the elevated loading dock. *Illustration by Stanley Beaman & Sears.*

Sustainable Site

Creating a sustainable site was a major consideration. Serving 11,000 students and 20,000 employees, Emory's 600-acre campus is an island surrounded by other development, including residential areas, a children's hospital, and the Centers for Disease Control and Prevention's (CDC) national headquarters. It is also heavily wooded, and the trees and green spaces are highly valued.

For connectivity, WCI was constructed in a high-density area adjacent to clinics, the children's hospital, and the university hospital. An existing 75,000-square-foot building was demolished, eliminating the need to disturb undeveloped land. With its compact design and integral outdoor healing garden, the building provides for green space on this dense site (figure 1). The hardscape was designed mostly with high-albedo materials to reduce the facility's impact on environmental temperature. As part of the overall campus transportation plan, public transportation and university shuttle buses serve the facility. Electric vehicle charging stations and designated carpool parking are also provided (figure 2).

Water Efficiency

Although Atlanta is blessed with plentiful rainfall, water efficiency is still an important issue here. Difficult negotiations between Alabama, Georgia, and Florida over water usage continue while the city faces a $2 billion bill for replacement of failing sewer infrastructure.

Healthcare and research facilities use significant amounts of water. To minimize WCI's water usage, the facility includes water-efficient land-

Figure 2. Emory is committed to developing a pedestrian campus. Alternatively fueled vehicles play an important role in the overall transportation plan. *Photo by Newcomb & Boyd Consultants and Engineers.*

scaping, including drought-tolerant plants, a high-efficiency spray irrigation system, and a sophisticated control system to minimize irrigation. Low-flow lavatories and laboratory sinks further reduce water usage.

In the laboratory cold rooms, a special recirculating system uses cooling water multiple times rather than just once to serve the water-cooled condensers. This reduces water usage and sanitary sewer load by more than 1,000,000 gallons per year.

A unique feature is the use of cooling-coil condensate for cooling tower makeup water: The laboratory cooling systems use significant amounts of outside air which, in Georgia, must be dehumidified. Once this moisture, called "coil condensate," is removed from the air, this makeup water is piped to the building's cooling towers to replace water that evaporates as part of the cooling process (figures 3 and 4). This system reduces building water usage by more than 900,000 gallons per year.

Energy and Atmosphere

Reducing energy usage is a critical component of sustainable design. At the WCI, all the refrigeration equipment uses HCFC-free refrigerants, which aren't as harmful to the ozone layer as those containing hydrochlorofluorocarbons. The mechanical systems were commissioned by a third party to ensure proper installation, operation, and documentation. Computer modeling showed that the WCI will use 20% less energy than if it were built only to building code minimum standards.

Some energy-saving features include high-performance glazing, high-performance lighting, and air-conditioning water chillers with variable frequency drives that modulate the compressor speed and chiller capacity to match the building-cooling load (figure 5).

One of the most important energy-saving features is a heat-recovery system for the laboratory ventilation systems. For safety, laboratory air systems use high flow rates of 100% outside air for ventilation, which is then exhausted to the outdoors. Cooling and dehumidifying or preheating and humidifying this air is, of course, energy-intensive. The WCI uses four energy-recovery units (ERUs) to reduce this energy usage (figure 6).

With this system, the laboratory's general exhaust air and ventilation air are brought together at the ERU, which contains a heat exchanger called a "heat wheel" (figure 7). The heat wheel is a large, porous aluminum disk covered with desiccant material. The wheel rotates in the parallel exhaust and ventilation airstreams, transferring heat and humidity from the exhaust stream to preheat the ventilation air in the winter, and transferring heat and humidity from the ventilation air back into the exhaust stream, where it is exhausted to the outdoors in the summer.

This system reduces the building-cooling load by 35%. Moreover, the energy-recovery system, along with other energy-saving features, will produce cost savings designed not only to pay for the systems but also to pay for all the WCI's sustainable design features. The facility contains an energy-monitoring system so that the university can monitor system performance over time to ensure that it is staying "green."

Figure 3. Cooling-coil condensate is captured from cooling coils to provide makeup water for cooling towers, reducing water usage. *Photo by Newcomb & Boyd Consultants and Engineers.*

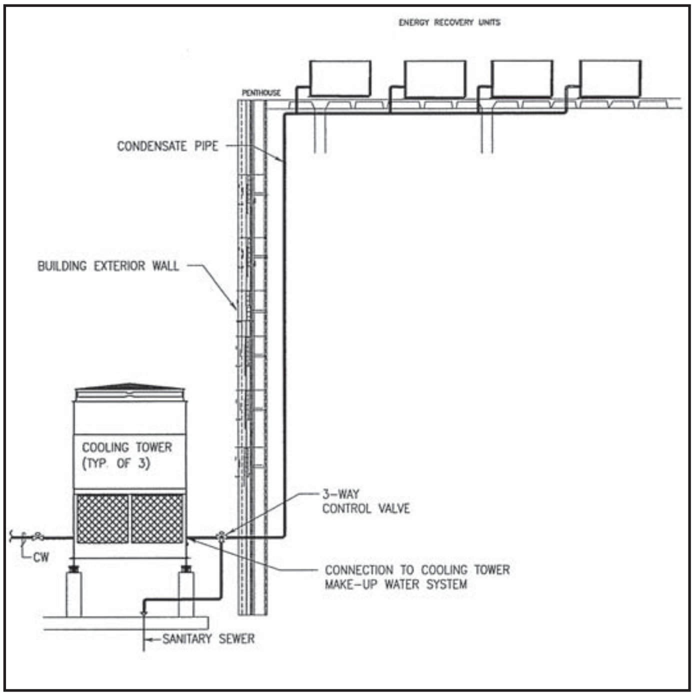

Figure 4. Moisture condensed from the air at the cooling coils is captured and piped to the cooling tower to provide a source of makeup water. This reduces water needs from the municipal water system. *Illustration by Newcomb & Boyd Consultants and Engineers.*

Figure 5. High-efficiency water chillers with variable-frequency drives match chiller compressor speed to the building cooling load, reducing machine electrical usage. *Photo by Newcomb & Boyd Consultants and Engineers.*

Figure 6. "Heat wheels" in four energy-recovery units reduce energy usage by preconditioning or preheating laboratory ventilation air with the exhaust airstream, reducing building cooling load by 35%. *Photo by Newcomb & Boyd Consultants and Engineers.*

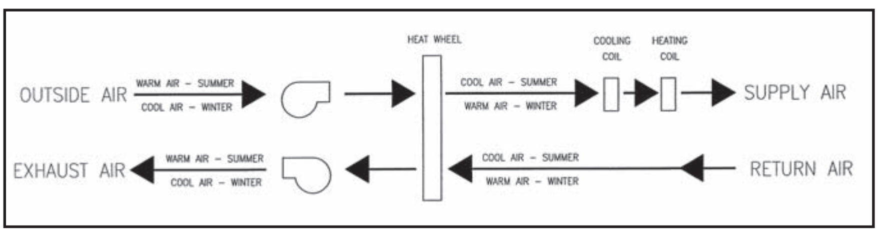

Figure 7. Sketch of an energy-recovery unit. *Illustration by Newcomb & Boyd Consultants and Engineers.*

Materials and Resources

Recycled materials represented more than 5% of the project cost. Some materials containing recycled material included: ceiling tiles, structural steel, concrete, lead bricks for shielding, fireproofing, glazing, insulation, steel and copper pipe, and miscellaneous metals.

Indoor Environmental Quality

In no other type of occupancy is indoor environmental quality more important than in healthcare facilities, especially in a cancer treatment center. The WCI was constructed to ensure that the building was free of contamination when it opened to patients. Low-emitting carpet, paints, and adhesives were used, reducing the amount of volatile organic compounds (VOCs) in the building. The building also was flushed with fresh air for two weeks before occupancy. Additionally, a sensing system was provided to monitor the carbon dioxide levels in the facility and to increase ventilation air quantities, if required.

Green Design Plus

Although the USGBC's LEED program has been a tremendous tool for sustainable design, not all worthwhile sustainable efforts can be easily categorized. For example, construction of the WCI required upsizing a sanitary sewer line on the adjacent clinic's site. Conventional trenching was out of the question, given that two fabulous, mature ginkgo trees stood in the path of the sewer line. Therefore, the sewer was replaced using a "pipe bursting" technique to save the trees (figure 8). With pipe bursting, a tunneling machine with an expanding head is inserted into the existing pipe. The head then expands, bursting the existing small pipe. Finally, the machine coats the inside of the bursted pipe with a lining material. The result? A new smooth, larger pipe—achieved without trenching.

With a steeply sloped site, the lowest floor of the WCI, which is used for imaging and radiology, was located approximately 40 feet below grade to match the existing hospital and clinic tunnel system for material distribution. During construction, a subterranean stream was discovered. Supplementing the designed retaining walls and waterproofing to withstand the additional hydrostatic forces from this would have increased construction costs by $7 million. Instead, the team increased the lowest floor elevation in two, three-foot steps from west to east. This design maintained the tunnel connection at the existing level on the west side, where the stream was located significantly below the foundations, but raised the foundations on the east where the stream was at a higher elevation (figure 9).

Figure 8. Pipe bursting was used to replace an undersized sanitary sewer serving the project in order to save the roots of this 60-year-old ginkgo tree. *Photo by Newcomb & Boyd Consultants and Engineers.*

During the design and construction of the facility, the university recruited Jonathan Simons, MD, a highly acclaimed physician-scientist, as director of the WCI. Changes subsequent to his appointment included significant increases in program area; however, the available site area was limited by adjacent buildings and green space requirements. Also, the building height was limited by negotiations with university neighbors. To accommodate the additional programs, the central cooling plant and main electrical distribution were relocated to a new, 7,500-square-foot mezzanine level below the elevated loading dock but above the existing tunnel level (figure 10). Through innovative design, the team provided more program space, improved equipment access, and added provisions for future expansion while maintaining green space and positive relationships with the facility's neighbors. Although the WCI received no LEED points for any of these features, each is important in minimizing the impact on the environment.

Conclusion

Sustainable design is more than a trend; it's an expectation many sophisticated owners have for quality construction. Buildings of every type can be constructed with sustainable features to minimize impact on the environment. Many sustainable features can be incorporated at no additional cost and, where added capital costs are incurred, life-cycle costs often show that a sustainable design costs less than traditional approaches, as demonstrated at the Winship Cancer Institute. **HD**

Gregory R. Johnson, PE, is a LEED®-accredited professional and an Associate Partner with Newcomb & Boyd Consultants and Engineers, an Atlanta-based consulting firm. In his 15 years with Newcomb & Boyd, his focus has been on healthcare and research facilities. He has spoken nationally and has been published on sustainable design issues. For further information, call 404.730.8400, e-mail gjohnson@newcomb-boyd.com, or visit www.newcomb-boyd.com.

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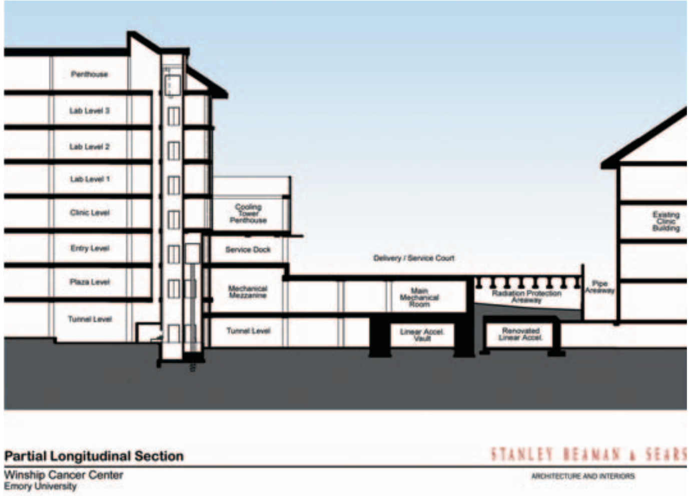

Figure 9. Mechanical and electrical equipment was moved to a mezzanine level below the loading dock to increase program space. The tunnel level was stepped to avoid a subterranean stream while maintaining a connection to the material-distribution tunnel system. *Illustration by Stanley Beaman & Sears.*

Figure 10. The mezzanine added between the Plaza and tunnel levels houses mechanical and electrical equipment, increasing space for healthcare programs. Platform lifts to the Plaza level provide access to the loading dock, while large roll-up doors and areas provide access for replacing very large equipment. *Photo by JJ Williams Architectural Photography.*

The Project

The seven-story WCI consists of about 60% clinical space and 40% basic-science research space. The lowest clinical floor is dedicated to radiation oncology and comprehensive imaging, including routine radiography, ultrasound, and bone densitometry; four CT, two MRI, and two PET scanners; and two linear accelerators. The other clinical floors include an 80-station infusion center, medical and surgical subspecialty clinics, a hematology/bone marrow transplant clinic, a women's diagnostic center, and a range of patient and family amenities. The three laboratory floors include flexible research labs, support space, office space, and a state-of-the-art conference center. *Photos by Gary Knight + Associates.*

Project Credits

Client: Emory University, Woodruff Health Sciences Center
Architect-of-Record and Project Manager: Stanley Beaman & Sears
Medical Planning and Interior Design: Stanley Beaman & Sears
Associate Architect for Exterior Design: NBBJ Architects
Laboratory Planner: GPR Planners Collaborative
Mechanical and Electrical Engineering: Newcomb & Boyd Consultants and Engineers
Structural Engineer: Stanley D. Lindsay & Associates
Landscape Architect: Hughes Good O'Leary & Ryan
Civil Engineer: Jordan, Jones & Goulding, Inc.
Construction Manager: Turner Construction Company
LEED Consultant: CH2M HILL
Photography: Gary Knight + Associates; JJ Williams Architectural Photography, Inc.
Completed: July 2003
Total Building Area (square feet): 265,000
Construction Cost: $59,500,000
Cost/square foot: $224