

STRUCTURE *and Function*

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Photos by Michael Collyer Photography



The purpose of any building can be easily guessed when structure is inspired by function. The stately academic halls and majestic setting of the University of Michigan's Ann Arbor campus suggests scholarly pursuits, even when students are not present. Campus newcomers also never need to rely on the roar of the crowd to find Michigan Stadium, as the facility was obviously constructed to accommodate great views and build lasting memories whenever the Wolverines take the field.

The University of Michigan Cardiovascular Center (CVC) similarly draws design inspiration from its intended use, actually resembling a human heart. Four chambers efficiently move blood inside a healthy heart, and the CVC is likewise designed for efficient movement of people and equipment within its walls. The CVC also sits at a vital juncture of the medical campus, essentially straddling the research and treatment areas of the grounds. A new building could have restricted access between the two sides, but the design incorporates several connectors to other buildings and a footprint that facilitates pedestrian and vehicular traffic. The heart pumps blood to the lungs to be oxygenated before it is sent out to sustain the

body, and the CVC's educational component serves a similar function, letting individuals enrich themselves with knowledge before using their newfound skills in the world beyond. Key members of the project team that created this heart-inspired facility included construction manager Barton Malow Company, Southfield, and architect Shepley Bulfinch Richardson & Abbott, Boston, MA.

FACILITATING CARE

The CVC represents a solution to a number of issues facing the U of M Health System. First and foremost, the existing hospital was running out of room. The need for new space could be perceived as a crisis, but also presented an opportunity for the construction of a new facility that would house related health disciplines in an environment that strongly encouraged interaction. Multiple specialists representing various disciplines treat patients with cardiovascular issues, and the ability of these health care practitioners to offer comprehensive care can be compromised if they cannot communicate effectively. The CVC brings together six departments: cardiology or cardiovascular medicine (including hypertension), cardiac surgery, vascular surgery, stroke care, interventional radiology,

and cardiothoracic anesthesiology. But simply putting everyone under the same roof would not guarantee true collaboration.

"We wanted everyone to cross paths," explained Linda Larin, FACHE, MBA, chief administrative officer for the CVC. "We didn't want to have a stroke area in one place and a cardiology area in another; we wanted the doctors to have to see each other. One of the challenges for the architectural team was to create office and clinical spaces that would bring people together."

Careful planning was employed to ensure that the approximately 420,000-square-foot CVC was easy to navigate and provided plenty of places for meaningful interaction.

"We zoned the building in a very simple way," said Elizabeth Ericson, FAIA, principal, Shepley Bulfinch Richardson & Abbott. "One side is basically patient orientation and the other side is basically staff orientation. The treatment areas are in the middle. That supports sustainability by letting us introduce daylight in the areas with the largest number of people and restrict daylight where instruments and procedures require controlled environments."

Instead of being located inside clinical



Few experiences are as stressful as a heart-related hospital visit. The U of M Cardiovascular Center was designed to calm frayed nerves with the beauty of extensive glass and natural light.

areas relating to their specialties, offices for physicians and other professionals are grouped together by specialty. Open and airy spiral staircases encourage interaction between floors, and consequently, departments. Ericson even recommended against placing coffee makers on every floor, an unorthodox suggestion that she has seen used to encourage face-to-face contact at other medical facilities. In addition to creating a space where healthcare professionals would interact with one another, the project team also created a unique healing environment.

A HEALING ENVIRONMENT

It is a well-known fact that many people ignore symptoms, sometimes for too long, before seeing a doctor. Although there may be some initial denial, most people react to telltale symptoms like chest pains or shortness of breath differently. Knowing that the problem might be related to the heart adds a sense of urgency and anxiety.

"There is probably nothing scarier than walking into a heart building," said Larin. "There is no question when something is wrong with your heart – it's not the flu or a broken bone – it's life and death. We really wanted to create an aesthetic where people knew they were in a safe, caring place as soon as they walked in."

Actually, the calming experience begins before patients walk in. Following advice from the architect, facility planners for the U of M Health System took a fresh look at

the outside appearance of the campus. The existing large white buildings served their intended purpose well, but most people would not call them inviting. With its extensive glass and natural light, the CVC softens the appearance of the entire campus, particularly at night. The facility was also built into a hill to reduce the scale and allow for a third floor main entrance.

Downplaying the size of a building can soothe visitors, but grand statements can

sometimes have a similar effect, especially when soaring spaces are filled with things that are pleasing to the eye. Plants and artwork are masterfully utilized at the CVC to fill many large spaces with a feeling of cozy intimacy.

Visitors drive through gardens atop the underground parking deck before entering the soaring glass atrium. Bamboo, black olive and fig trees lift eyes and spirits up to their top branches 30 feet above. The trees will eventually reach 50 feet, letting their expanding foliage pleasantly diffuse natural light throughout the building. This unique space also includes a water feature with soothing sounds to calm frayed nerves. Some healthcare facility planners shun living gardens because of allergy concerns, but these can be successfully addressed with careful plant selection and a diligent maintenance commitment designed to prevent dust accumulation. Water in the CVC garden is kept in a constant state of motion to prevent algae growth. Despite the need for careful planning, many see strong benefits associated with healing gardens.

"I really believe that connections to the natural world are a part of the healing process," said Ericson. "Sometimes just seeing a flower can be as transforming as the latest drug."

Art can also be uplifting, and almost any healthcare setting includes space for art. What sets the CVC apart is the planning that went into filling those spaces. Instead of seeking out individual pieces, planners created a unified collection for the CVC



Individual partition walls in the cardiothoracic ICU provide privacy while glass walls facing the corridor let healthcare professionals keep a close eye on patients. Small corridor alcoves provide convenient workspaces for nurses.

with specific goals in mind. Waiting areas, where a person would likely be bored, include vibrant pieces with complexities that can be studied over time, while intense treatment areas feature artwork with a softer palette and simple designs that can soothe at a glance. Visitors to the CVC will also see art that speaks specifically to them, as great care was selected to create a multicultural collection to reflect the unique life experiences of all visitors in a variety of mediums including painting, sculpture and textiles. The highlight of the collection is a 1,200-pound bronze statue sitting against a limestone backdrop in the main entrance lobby. Dedicated to the staff and facility at the CVC, the sculpture is titled "My Heart is in your Hand", but the signature piece also represented a unique task left in the hands of contractors.

"We needed to put some floor reinforcing in for the sculpture," said Gary Simmons, superintendent for Barton Malow. "I had to make sure that was done, along with the backing and the lighting, so we wouldn't have to go back and do renovations."

Even the walls at the CVC can be considered art. Pontiac Ceiling & Partition Co., LLC, Pontiac, installed nearly 1.5-million-square-feet of drywall, much of which involved complex geometry including intricate reveals and radii. The company was able to couple the beauty of art with the efficiency of mass production by carefully preplanning the work.

"The layout is the most crucial portion of the job," said Phil Ruffin, president of Pontiac Ceiling & Partition. "We did mock-ups of the rooms early on, and we measured everything to make sure that it fit together properly before going forward with any mass production. Once we got all the bugs worked out on the mock-up, everything flowed smoothly from there."

In addition to providing a visually stimulating design, the walls installed by Pontiac Ceiling & Partition serve many practical functions over and above simply dividing spaces. The gentle curve of the radius wall enhances the view from central nurse stations into the 24 individual patient recovery rooms. Individual partition walls in the cardiothoracic ICU provide privacy while letting healthcare professionals keep a close eye on patients via glass walls facing the corridor. Small corridor alcoves positioned in between every two rooms, provide nurses with convenient workspaces from which they can perform their duties without disturbing patients. Family needs were also taken into consideration with numerous meditative spaces called quiet rooms, which are placed throughout the facility.

Jeff Stone, project manager, and Larry Skaug, project foreman, efficiently moved workers and materials around the jobsite to help Pontiac Ceiling & Partition deliver these spectacular results. Barton Malow took the lead in coordinating these efforts with many other contractors as well as the hospital staff, as there were many logistical issues associated with the project.

LOGISTICAL ISSUES

Providing access to any jobsite in an urban landscape can be a challenge. Adding a working hospital into the mix complicates this considerably.

The construction team needed to maintain circulation around the building for emergency vehicles, provide access to two loading docks at nearby buildings, and accommodate another major construction project on the ever growing campus. Utilities to the hospital also could not be interrupted. The CVC features five separate connections to nearby buildings, including two underground connections some 60 feet below grade. Given the tight nature of the site, intense earth retention systems were needed, including a 50-foot permanent retention wall that separates the intersection of Ann and Observatory Streets from the 450-vehicle underground

parking deck. The project team worked with Ann Arbor to obtain a long-term license near city streets and provided as-built drawings detailing the location of the tiebacks to prevent future road projects from compromising the stability of the retaining wall. Contractors moved massive amounts of soil to place these retention systems, but they never knew exactly what they would find when they started digging.

"The site was the location of the old main hospital," said Mary Krasny, associate director of real estate and design for the University of Michigan. "It was demolished, but it was never 100 percent certain if all of the foundations were taken out. We encountered some foundations that were not on the drawings, but our biggest surprise was a telephone duct bank that fed the main hospital. It had to be re-routed along the streets that surround the Medical Center because we couldn't bisect the site."

Working on the campus constrained construction operations in many ways. Deliveries were coordinated to bring in materials just when they were needed because of limited space for stockpiling. Tradesworkers were also bussed in several times a day to prevent them from taking parking spaces required for the smooth operation of the hospital campus. Tight spaces also limited the



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number of cranes that could be accommodated on the site.

"We only used one tower crane for most of the project, but we brought in some hydraulic cranes during the steel erection process," said Simmons. "We brought in a Triple Eight (Manitowoc Model 888) for the parking deck because the crane needed to reach the entire structure, which follows the contour of the roadway. We also needed to make sure there was no interference between the Triple Eight and the tower crane. They shared some of the same air space."

Spotters were deployed to ensure safe crane operations and Barton Malow even lent their cranes to other contractors, thereby eliminating the need for additional pieces of equipment that could have hampered operations on the jobsite. Cranes were not the only type of equipment hindered by the tight site, close proximity to occupied hospital buildings placed equipment emissions under careful scrutiny.

"Unfortunately, all of the air intakes for the existing buildings were looking right at us," said Simmons. "When you're that close, the diesel smell is nauseating. Anytime the wind blew from the wrong direction, people inside might pick up an odor from a concrete truck or an excavator. After we were notified about the problem, we would either relocate until wind changed direction or quickly finish what we had to do and pull out."

Many problems were averted by mandatory use of biodiesel fuel and scrub-

bers. Instead of a harsh diesel smell, biodiesel gives off an aroma more like sizzling French fries, while scrubbers operate much like catalytic converters by burning residual fuel in the exhaust system. Simmons noted that neither of these two steps presented a major inconvenience, but fuel did need to be certified as biodiesel prior to its use on the site and scrubbers were also inspected to ensure they were in working order. According to Simmons, scrubbers generally do not have a major impact on newer equipment, but older machines can experience problems due to backpressure.

Proactive steps taken on the jobsite prevented many problems during the construction process. The project team applied a similar approach with the planning of the facility itself, as careful thought was given to future needs.

BUILDING FOR THE FUTURE

Building for the future of healthcare is a tricky proposition, as no one really knows what new technologies will emerge and what infrastructure will be needed to accommodate them. Crucial design decisions were postponed as long as possible at the CVC to facilitate late-breaking medical equipment advances.

"There was one room where the equipment was being designed as we were literally designing the room around it," said Mary Pinegar-Koster, associate project director for the University of Michigan.

The challenges associated with keeping equipment options open were augmented

by the elaborate mechanical and electrical systems needed to supply the machines. This created a "trickle-down effect" where the placement of systems impacted surrounding rooms, but careful coordination with subcontractors who installed these systems prevented this from impacting the overall quality of the project.

Building for the future takes on many other connotations from a facility standpoint. Expansion is frequently a consideration, and it is well planned for at the CVC. Empty shell space at the CVC is already filling up to meet new demands, but the building was also carefully sited to allow for multiple additions and the mechanical system was designed with the capacity to adapt for future needs.

Green building is another concern among facility planners who are truly building for the future. The CVC includes a number of features to reduce energy consumption including a white EPDM roof to reflect sunlight, motion-sensor controlled lighting, heat recovery wheels, thermal mass insulated exterior architectural precast panels, and low-e glass. The facility also reinforces the pedestrian focus of the campus by introducing a walking path and including bicycle racks. The landscaping that replaced the existing paved parking lot addresses runoff concerns by letting water percolate into the ground. Green materials utilized on the project include various types of wood, linoleum, tile, glass and low VOC paint.

Preference was given to local manufacturers who could minimize the environmental impact of shipping materials to the jobsite. National Precast, Inc., Roseville, was a vital part of this effort.

"Our plant is in Roseville, Michigan, about 50 miles away from Ann Arbor," said Mike Mourad, project manager for National Precast. "All of our materials are basically local, including the cement, aggregate and rebar."

The versatility of precast was demonstrated as National Precast easily accommodated the complex geometry of the project, including the convex and concave faces of the large curved wall. Precast is often used on projects that require many identical pieces, but Mourad estimates that about 80 percent of the 700 pieces created for the CVC job were unique.

The function of the CVC ultimately drove material selections and other decisions. While the precise function of the facility may not be obvious to a visitor, healing is strongly communicated by the gentle feeling of warmth that pervades every inch of the structure. ❖