Designed for Optimal Energy Efficiency

Children's Mercy Research Institute

BSA

Children's Mercy

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Beyond being a tech-savvy, visually stunning addition to the landscape of Hospital Hill, Children's Mercy Research Institute's new headquarters exemplifies optimal energy efficient design.

Thoughtful, deliberate design and engineering of the array of systems that will power the new research institute is the result of years of planning, coordination and collaboration between BSA LifeStructures, owner Children's Mercy Research Institute, MEP engineer Brack & Associates, structural engineer Bob D. Campbell and Company and Architectural Wall Systems LLC.

BSA LifeStructures Director of Architecture Jacqueline Foy, LEED, AP, said planning to design the building's systems began five years ago. The project was challenging to design a non-traditional laboratory and research building with a glass façade, open spaces and a monumental stair.

"We knew early on that glass would be the main exterior material, and we knew we would need the inside to be flexible and adaptable to meet the needs of changing research," said Foy. "This meant minimizing additional interior wall construction. It started us down the path to push the limits of traditional curtain wall systems."

Children's Mercy Research Institute's various building systems, inside and out, have been designed and engineered to achieve maximum energy efficiency for the client throughout the life cycle of the building.

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"The form of both the building and the monumental stair on the west side are inspired by science and by the research that will take place inside," Foy said. "It was especially important to consider energy impacts at the monumental stair. Without the ability to have clear-vision glass, the structure of the stair would be lost and the connection to the institute's purpose would not be on display. However, ignoring the energy requirements would mean no one would ever use this space," she added. "Working alongside partners that understood the importance of balancing energy efficiency with aesthetics allowed for the true vision of the building, and specifically the monumental stair to be realized."

Architectural Wall Systems (AWS) was the design-assist partner for the all-glass curtain wall system that is already a focal point for motorists traveling south along Interstate 35 or Highway 71 and westward on Interstate70 as they approach Kansas City. "Children's Mercy Research Institute is an emerging, identifiable landmark for Kansas City just south of downtown," said Brad Davison-Rippey, AIA, system design manager at AWS. "It definitely has a presence on Hospital Hill."

BELOW | *Without the ability to have clear-vision glass, the structure of the stair would be lost and the connection to the institute's purpose would not be on display.*

The curtain wall system, according to Davison-Rippey, is 12 inches in depth, notably thicker than standard commercial curtain wall systems that measure six to seven inches deep. “The primary reason we ended up with such depth is due to the amount of insulation we needed in the spandrel area, the area of the curtain wall that wraps all the spaces that need obscuring between the ceiling and the bottom of the structure. To optimize energy efficiency, we got really creative so we could make sure the insulation in these areas was as continuous as possible. There are approximately six inches of insulation in these cavities, easily half of which is continuous,” he added, noting that the curtain wall’s frames ranged from a U-value of .22 to .24, compared to typical curtain wall frames that have a U-value ranging from .35 to .40. “Our project team is proud of the level of efficiency this building possesses, particularly in light of all the glass it has. It’s a real win for the owner,” he said.

The diagrid curtain wall – an aerodynamic system comprised of interlinked triangles that eliminates the need for vertical columns – fills the space between the main tower and the monumental stair from ground level to just above the sixth floor. Diamond-patterned glass designed with the project’s four primary glass colors but also pulls in various blues and greens from the existing hospital. The main tower and the iconic stair each have an independent unitized curtain wall system.

Sequencing of the building’s construction enabled AWS to prefabricate all of the unitized curtain wall system components off site as the structure was being erected. “Prefabricating allowed us to install the curtain wall system one five-foot-tall by 16-foot-wide frame (weighing 900-1,000 pounds) at a time,” Davidson-Rippey said. “It took us two to three weeks to wrap each floor, with a total of more than 1,400 prefabricated frames for the entire structure.” The glass was sourced from Viracon in Owatonna, MN, and installed into frames fabricated by AWS’ partner Sotawall in Toronto, Ontario.

Foy said the project team spent much time and research to create the variations of the glass that are positioned within the unique curtain wall framing that wraps Children’s Mercy Research Institute.

“There is a very distinct and precise pattern on the glass,” she said. “It was important that the colors and reflectivity of the glass allowed the pattern to reveal itself. This time it was the balance between the performance of the glass and its reflective films that helped complete the design intent of the pattern.”

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Another example of energy efficiency design is the triangular glass wall dividing the building’s main entrance from the interior with an eight-foot by eight-foot “glass box” vestibule. The glass box feature, according to Foy, adds another layer of separation from one area to the next, reducing the strain on mechanical systems specific to heating and cooling needs spurred by occupants entering and existing the main entrance. BSA LifeStructures’ designs were embodied in a 3-D physical model of each building system.

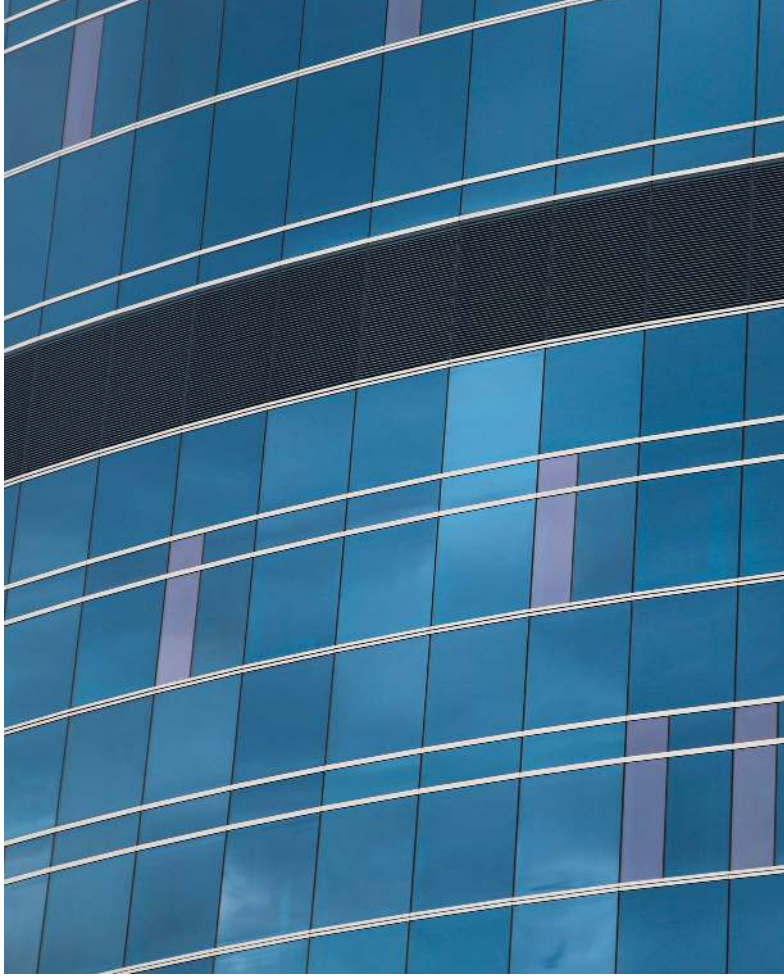
Balancing and regulating the amount of daylight streaming into the new research institute structure also proved an instrumental facet of designing and engineering for maximized energy efficiency. Children’s Mercy Research Institute, BSA LifeStructures, partner Brack & Associates and McCownGordon Construction. The companies’ representatives met weekly throughout the life of the project to ensure every detail of the sizes and requirements of the building’s mechanical, electrical and structural systems designs (engineered by Bob D. Campbell and Company) interacted with one another to operate at the highest level of energy efficiency possible.

“Our first concern was how this large addition to the hospital’s existing physical plant was going to impact their ability to power the systems in the new research institute building,” said Dave Krug, vice president of Brack & Associates and project manager. “We built the new building’s systems onto an ongoing, existing chilled water system project at Children’s Mercy Kansas City that was already underway when this new project began. We projected that Children’s Mercy Research Facility was going to require another 1,200 cooling tons. When they began planning for this research institute facility 20 years ago, they laid plans to build a second (energy) plant adjacent to the new structure that is nearly completed.”

The advantages of tying both plants – the original energy plant built to power the hospital three decades ago and the newer energy plant to supply the research building – are clear in terms of equipping Children’s Mercy Research Institute for maximum energy efficiency, according to Krug. The new chillers are state of the art, he said.

“We added two 1,000-ton, magnetic-drive centrifugal chillers to the owner’s cooling system that are newer technology,” said Krug. “Each operates at about 15 percent higher efficiency than a conventional centrifugal chiller. Instead of needing bearings, the new chillers are designed with a magnetic shaft.”

Energy efficiency also abounds within the laboratories housed in the new research institute. Krug said a Kansas City-based global manufacturer of lab fume hoods, Labconco, fabricated tech-forward hoods that detect if the user has walked away with sensors that automatically close the sash, decreasing the air flow required for safe operation of the hood to save exhaust-related energy draws. “We project that these lab fume hood sensors will save the owner about 40 percent in energy operating costs annually,” he said.



ABOVE LEFT | *There is a very distinct and precise pattern on the glass and it was important that the colors and reflectivity of the glass allowed the pattern to reveal itself.*
ABOVE RIGHT | *The curtain wall system is 12 inches in depth, notably thicker than standard commercial curtain wall systems that measure six to seven inches deep.*

The lab exhaust system is also designed and engineered to require a lower amount of outside exhaust, saving additional energy. One example of this energy efficient design is the use of Type C biosafety cabinets. The specialized cabinets are designed to reduce the amount of exhaust required yet maintain a safe environment within the research labs.

Variable air volume controls providing the proper amount of exhaust and supply to keep positive and negative air pressure relationships in balance

are further evidence of facility systems design that supports energy efficiency, said Krug. “Emergency push buttons that send the exhaust system into purge mode in the case of a sudden, high quantity of air needs pushing – should there be a chemical fume release – are another sophisticated mechanical system in this new facility,” he said. “While providing a safe, comfortable environment in which researchers will work, the system will also utilize only the required amount of energy needed.”

A heat recovery system with a run-around loop that’s able to recover some 40 percent of the heating or cooling that would typically be lost in a traditional, single-pass laboratory mechanical system is another energy efficient facet of Children’s Mercy Research Institute’s design.

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BSA LifeStructures, a national, integrated design firm, creates inspired solutions that improve lives. BSA provides architecture, engineering, interior design and planning services for spaces that support and enhance healing, learning and discovery – facilities known as LifeStructures.

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FRONT COVER | *The form of both the Children's Mercy Research Institute building and the monumental stair on the west side are inspired by science and by the research that will take place inside.*

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BSA LifeStructures is an integrated design firm creating inspired solutions that improve lives through architecture, engineering, interior design, and planning services. With national expertise and regional leadership, BSA designs LifeStructures – innovative and inviting spaces that not only house the activities of healing, learning, and discovery but actually contribute to them – in order to make a difference for our clients and communities. As such, a LifeStructure is purposeful, a LifeStructure inspires, a LifeStructure delights and a LifeStructure improves lives.

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