National Guard to set up a 60-bed tent hospital (called a Mobile Medical Unit) in St. John’s parking lot. The hospital’s medical staff began seeing patients at the tent hospital just a week after the tornado. The tent hospital was later replaced by portable buildings with walls and ceilings made of insulated panels. The portable buildings would offer additional protection against the harsh winter weather.

In September 2011, McCarthy began installation of a third, more secure temporary facility: a 165,000 square foot modular “component” hospital consisting of 224 steel and concrete modules engineered in Southern California. The component hospital opened in April 2012 and served the community while the permanent hospital was being built.

On January 29, 2012, demolition of the old hospital began and a groundbreaking ceremony was held for the new hospital. The new facility is located approximately three miles southeast of the old hospital on a highly-accessible, 100-acre site just south of I-44.

On January 31, 2012, the St. John’s Regional Medical Center name was formally changed to Mercy Hospital Joplin as part of a corporate rebranding.

PROJECT TEAM

McCarthy was Construction Manager at Risk for Mercy Hospital Joplin. In July 2011, they began working with Mercy and other members of the team to determine the various factors that would go into the design of the replacement hospital. They completed the program in November 2011. The program management team included Archimages, Inc. of St. Louis; HKS Architects, P.C., of Dallas; and Heideman Associates of Ballwin, Missouri.

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As Construction Manager at Risk, McCarthy provided preconstruction services, established a budget, developed the schedule, and managed the project from start through completion. The McCarthy team included Ryan Felton, Project Director; Mike Staf, Preconstruction Director; and Steve Meusche, Senior Project Manager.

HKS, the Design Architect and Architect of Record, was represented by Norman Morgan, AIA, Principal-in-Charge, and Tim Solohubow, AIA. Archimages, Inc. was represented by Greg Garner, Principal/Design Coordinator, and Jim Huber, RA, Principal.

Jamison Bloebaum, P.E., Heideman Associates, was the Mechanical Engineer of Record, and Tim Koenig, also with Heideman Associates, was the Electrical Engineer for the design of the hospital. John Farnen, Executive Director, Mercy Strategic Projects, was the Owner’s Representative. The Owner, Sisters of Mercy Health System, is one of the nation’s largest Catholic healthcare systems.

Safety was a top priority throughout the project. In June 2014, McCarthy hosted an OSHA Fall Safety Stand-Down event at the Mercy Hospital construction site. The stand-down was attended by more than 450 workers and included presentations and training on fall safety. McCarthy achieved a 1.44 total project incident rate (well below the national average of 3.6) and a .14 lost-time incident rate during 2.8 million worker hours through March 31, 2015.

Mercy Hospital Joplin is an 890,000 square foot structure designed for 260 beds, all of which are private beds for better efficiencies and utilization than St. John’s, which contained semi-private beds. Although the new hospital has fewer beds than the former facility, the latter averaged only about 200 patients a day. Also, when Mercy teamed up with McCune-Brooks Regional Hospital following the tornado, they gained 25 beds there. (McCune-Brooks, a smaller hospital about 15 minutes north of Mercy Hospital Joplin, is now known as Mercy Hospital Carthage.) Behavioral health beds are located in another Mercy facility in Joplin.

Construction costs accounted for $345 million of the project’s total $465 million cost, which included approximately $9 million in upgrades designed to harden the new hospital against natural disasters.

Fast-Track Schedule

Following the tornado, the hospital was planned, designed and constructed in only 46 months. “This was approximately half the time you would normally anticipate for a similarly-sized hospital,” stated Ryan Felton. HKS issued its certificate of substantial completion on January 18, 2015. The hospital opened its doors to patients on March 22, 2015.

“The new hospital was originally budget at approximately 1.5 million square feet,” said Steve Meusche. “During the program phase, Archimages, as part of the collaborative healthcare design team, worked with various hospital department users to define the total square footage and scope of the project. The department users reported back to the consultants and designers on the amount of space they would need to operate their respective service lines efficiently. As a result, the new hospital contains roughly the same square footage in one building as the old St. John’s facility contained in four separate buildings, and was completed under budget.”

To accomplish the fast-track schedule, McCarthy collaborated with the project team to create 10 different bid packages. This helped determine what materials would be needed and when, and allowed construction to begin just three months after design got under way. The packages included: 1) mass grading; 2) final grading; 3) foundation; 4) steel; 5) flatwork, landscaping, and exterior signage; 6) exterior skin; 7) ground, first and second floor fitout; 8) road improvements; 9) patient tower fitout; and 10) clinic fitout.

McCarthy was also able to accelerate construction by having the headwalls and restroom walls prefabricated in a warehouse and installed in the patient rooms later on during construction.

The mass grading/excavation package included demolition of 18 houses on the 100-acre site as well as portions of the old Messenger College facility. (Messenger College, the national collegiate institution of the Pentecostal Church of God, relocated to Texas in 2012.) The package also included removal of 100 tons of rock (much of which was blasted out) and one million yards of dirt.

“The lower level, about 80,000 square feet, was blasted down to elevation while the mechanical was being designed,” noted Steve. “We were just about to start the foundations when we were notified by the mechanical engineers that an additional four feet would be needed for the ductwork.”

During a six-week period in the early summer of 2012, the McCarthy team worked night shifts and weekends to recover the time lost time excavating the additional four feet. “The foundations were ready and we were back on schedule when the steel arrived the day after Labor Day 2012,” said Ryan Felton. “That was a milestone I won’t forget.”

Checkerboard composite metal decking and

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a lightweight concrete floor slab system were installed to minimize vibration within the building’s long floor spans, noted Ryan. Steel frame connection technology was employed to help eliminate cross-bracing and x-bracing and maximize floor-to-ceiling heights – creating more space to run the MEP systems, he added.

The worker peak was reached during the winter of 2014, when there were roughly 850 tradesman on site, according to Steve Meuschke. “At that time we were wrapping up the building exterior, starting drywall on the interior, and pushing towards the finish line at the Central Energy Plant,” he recalled.

**DESIGNED FOR PERMANENCE**

“In the design of the new facility, Mercy incorporated design features to make the facility more resilient. Mercy’s goal was to protect the lives of those in our new facility and to provide a place of refuge for the community. Mercy also wanted to make sure our facility stays open to provide services to the community when they need it most,” said John Farnen.

The damage from the tornado would be carefully analyzed so the new hospital could be designed and constructed to protect against future tornadoes. During testing of the windows, an air cannon was used to blast wooden 2x4s at high speeds to simulate the effect of flying debris during a tornado, noted Ryan.

At St. John’s, only the laminate glass used in the behavioral health unit had survived. Based on this experience, custom-made windows with laminate films were designed to withstand damage from winds up to 250 mph, 140 mph, or 110 mph. The 250 mph-rated windows were installed in the intensive care units to maximize safety for the most vulnerable patients. The 140 mph impact-resistant glazing was used on the bridge (which connects the patient tower and clinic tower on floors 3-5), and the 110 mph windows were used in the common areas. The glass is framed into an aluminum curtain wall, which is securely fastened to the building in order to better absorb the impact of a catastrophic storm.

Precast concrete finishes, as well as the lightweight concrete slab installed beneath the roof, help harden the exterior. The new roofing system is a safe alternative to St. John’s ballasted roof, which had been weighed down by gravel. During the tornado, the rock became projectiles that shattered windows.

Each floor of the hospital has a special hallway with reinforced walls and ceilings as well as heavy storm barriers which can be closed for added safety. Rods in the door hardware penetrate the cement above for added stability. All passenger elevators connect to the basement where widened corridors provide refuge for co-workers and patients. Hallways and stairwells have battery-operated lights that will automatically turn on. Critical life-support systems such as ventilators have their own battery backup.

**CENTRAL ENERGY PLANT**

The hospital is connected by a 450-foot concrete underground tunnel to a 30,000 square foot Central Energy Plant (CEP) containing all of the MEP systems. The CEP was built into a hill on the east side of the hospital to minimize exposure to the elements, and has a hardened concrete exterior, stated Steve Meuschke. All of the main utilities feeding into the hospital via the tunnel, as well as the electrical feeds from the local utility, are redundant; if one substation

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goes down in a tornado another substation will be available. The CEP also houses two generators, either of which can power the hospital independently. The new generator system will enable the hospital to operate for 96 hours in the event of a power failure.

**ENERGY SAVINGS**

The new facility incorporates a number of energy-saving systems. These include a proprietary system which optimizes chiller run times and water temperatures based on loads, and a boiler exhaust heat recovery system which uses exhaust heat from the boilers to preheat boiler heating water.

Fanwall technology is used in the outside air units. The use of many small fans with smaller motor sizes (instead of one large fan) provides redundancy, expedites maintenance, and allows each fan to operate at peak efficiency. Heat wheels in the 100% outside air units remove heat from the return air in the winter and use it to reheat the incoming supply air. During the summer months, the heat wheels act to remove heat from the incoming supply air.

Daylight harvesting is used in the main atriums as well as in the public dining area located along the exterior of the building on the first floor. Motion sensor controls in the staff and other nonpatient areas cause lights to turn off when spaces are not in use. LED lighting is used both for interior down lights and under-cabinet light fixtures, and programmable LED lighting is used for the parking lot fixtures.

“Mercy Hospital Joplin was a project like no other – one that really would and is changing a community. HKS and McCarthy gave the community of Joplin a sense of hope as they rebuilt. The new hospital has definitely been the most rewarding project of my career, and we could not have done it without the collaboration and partnership of McCarthy,” said Norman Morgan, AIA. ▲