Taking Children's Services to New Heights

BY DAVID A. BAUER, P.E., AND ROBYN A. LARWOOD

THE EAST TOWER EXPANSION of the State University of New York's Upstate Medical University, located in Syracuse, is a six-floor addition of approximately 230,000 sq. ft. Designated as the Golisano Children's Hospital, the top two floors more than triple the space formerly devoted to pediatric services. The other floors in the East Wing expansion are dedicated to cardiovascular, neurology and oncology services. The project launched in 2003 with a study, and the hospital expansion opened in September 2009.

This complex project's program requirements created a number of structural challenges. Constructed on an existing concrete building, the addition was planned with a heavy five- story concrete frame with a heavy masonry exterior wall system. The university wanted to maximize the interior square footage, because this densely developed urban site restricted further additions. The use of steel framed floors reduced dead loads, and allowed an extra floor to be added to the project. The incorporation of a curtain wall reduced the loads further, so the building addition could cantilever and add more square footage to the north and south edges of the addition.

The existing column grid had 25-ft bays, but the architect desired more open bays in the new floors so the nursing stations would have less obstructed views of the patient rooms. Steel transfer trusses at the lowest level of the addition spread the column spacing out in one direction. This same transfer truss system supported the addition's north and south cantilevers. At this transition level, the building column loads from above are spread to the existing 25-ft column grid below.

The transition level houses the enormous mechanical systems that support the hospital addition. The mechanical level has a floor-to-floor height of 20 ft, and the transfer truss system is braced at the truss bottoms, so the lowest steel columns have an unsupported height of only 10 ft. The 10-ft-tall transfer trusses were constructed with W14 members, and have open space used for mechanical duct and pipe runs. Below the trusses, the air handling units, pumps, electrical gear and other equipment occupy a 10-ft space.

Among other mechanical challenges was the need to keep the existing two-story-high cooling tower operational at the existing

Steel framing enabled inclusion of an additional floor in this vertical expansion on a constricted site.


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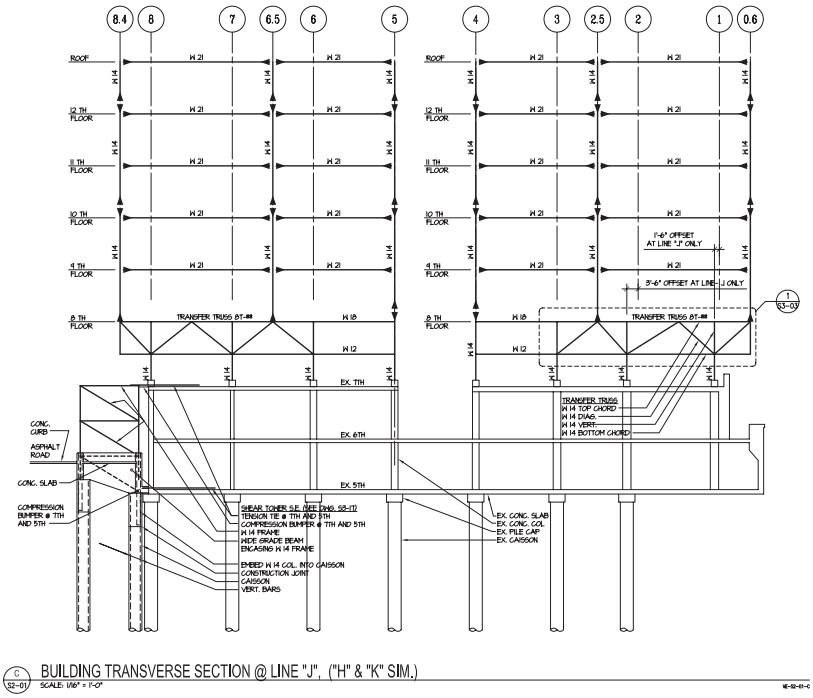
- The completed east side showing the tree house entry and canopies.
- Transfer trusses along one axis of the building made it possible to provide longer clear distances between columns in the new floors.
- Primary construction access was confined to the east side of the structure, where locating a 190-ft tower crane provided a 267-ft reach.



BUILDING TRANSVERSE SECTION @ LINE "J", ("H" & "K" SIM.)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roof until the cooling towers on the new roof were active. The sequence required temporarily omitting two bays of framing above the existing unit. At the appropriate time, the existing cooling tower was selectively demolished. Following that, the floor was constructed at the two open bays.

A helipad on the roof constructed of galvanized steel framing includes an enclosed walkway designed to shield patients and personnel from frigid Syracuse winters. Constructing the enclosure with steel framing, along with metal roof and wall panels, reduced the cost of the walkway. The building addition main roof was also populated with mechanical equipment.

Seismic design was not required in New York when the original East Wing was constructed, although it is now. The new addition also is taller than originally planned so it attracts more wind load. The new seismic and wind loads required an upgrade of the existing lateral system below the addition. External shear towers on the south side, along with a new shear wall on the east side, provide the additional lateral support required. All three external lateral structures required ties to the existing roof diaphragm to support heavy lateral loads.

The tree house structure has a dual lateral support system. The elevator and stair towers are moment frames; the 11th floor, 12th floor and the roof are tied back to the main structure. In the north-south direc-

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◀▲ Steel framework in place for the tree house and the completed structure.

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▲ The completed addition seen from the side of the building opposite the entrance to the Golisano Children's Hospital.

▼ Construction and erection of the transfer trusses at the southeast corner, showing similar floor cantilevers in an adjacent building.

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tion, the tree house roof and floors have below-deck horizontal trusses that connect to the main building.

The tree house is perched on a hill at the corner of Irving Avenue and Adams Streets, which lead to nearby Syracuse University and the Carrier Dome. This skyline-topping hospital structure has also achieved a landmark status in the city. The architect designed the tree house structure as a dedicated entrance that mimics the adventures of childhood. It serves as a welcoming center for the 11th and 12th floor Children's Hospital, where patients and families gather in a setting more playful than clinical, designed to promote healing. .

At the ground-level entry, canopies incorporate architecturally exposed structural steel. They are designed to resemble trees, with large steel pipe tree trunks and steel pipe branches, culminating in the smallest pipes at the top that support the canopy roof. The front of the main addition has two peel-away sweep walls supported by architecturally exposed steel outriggers that cantilever from the building's main columns. The peel-away strips draw additional attention to this building's multicolored curtain wall skin behind them.

Easy Integration

The architectural expression of the tree house, the canopies and the peel-away walls are testaments to the versatility of structural steel. Steel is so easily integrated into the support of architectural concepts that multiple structural solutions are usually available, even for structures as complex as this tree house. There are many belt-and-suspender support systems made possible through steel detailing. The tree house cantilever ends have vertical ties, so if a single level experiences an overload, that load can be spread to the other levels. These vertical ties also control cantilever end deflection. The cantilever girders were extended back to the main building as a back-span for stability.

The main building addition and the tree house were modeled and analyzed separately using RISA-3D analysis software. Later in the project, the two RISA models were joined and analyzed as a single model. The tree house analysis included some non-typical load combinations because of the cantilevers.

The phasing complexities of this job required a construction manager on the team during the design phase. No construction access existed on the west and north sides of

➤ Once the large cooling towers were erected on the new roof, the older equipment below could be removed. The engineer near the ladder provides a sense of the unit's size.

the addition, which were hemmed in by other structures and the existing ambulance entrance. Limited construction access was available on the south side due to an adjacent access road where trucks made daily deliveries to both Upstate and a neighboring hospital. The only construction access was on the east side, and this required a 190-ft tower crane with a 267-ft reach. Extra precautions were taken constructing the first level, because the intensive care rooms directly below the addition remained in service during the project.

The building core/shell portion included the structure and the building envelope. The core/shell general contractor had a separate bid package, and was required to work simultaneously with separate contracts for mechanical, electrical, and interior fit-out, plus owner-supplied hospital equipment.

This project was built to conform with many requirements for LEED Certified status, although certification was not pursued. Most of the exterior walls were curtain walls, and the non-window panels have a second light-gauge metal framing partition with additional insulation. The curtain wall allowed natural light to brighten the rooms. Some exterior walls were constructed with an exterior finish insulation system backed by cold-formed metal framing.

Altogether, the vertical expansion project for Upstate Medical University cost $140 million, with 19 companies involved in the design and construction. Approximately 2,200 tons of steel were used in this effort. The result augments area health care with 209 additional patient beds and a Children's Hospital which serves a 17-county sector of the state and includes areas of Pennsylvania and Vermont. To learn more about the Golisano Children's Hospital, visit www.upstate.edu/gch. MSC

▲ The elevator and stair towers in the tree house are moment frames. The cantilevers have vertical ties to provide redundancy and some measure of deflection control.

▼ One example of how the steel roof beams are used to support heavy medical equipment.

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Structural Engineer
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Steel Erector
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