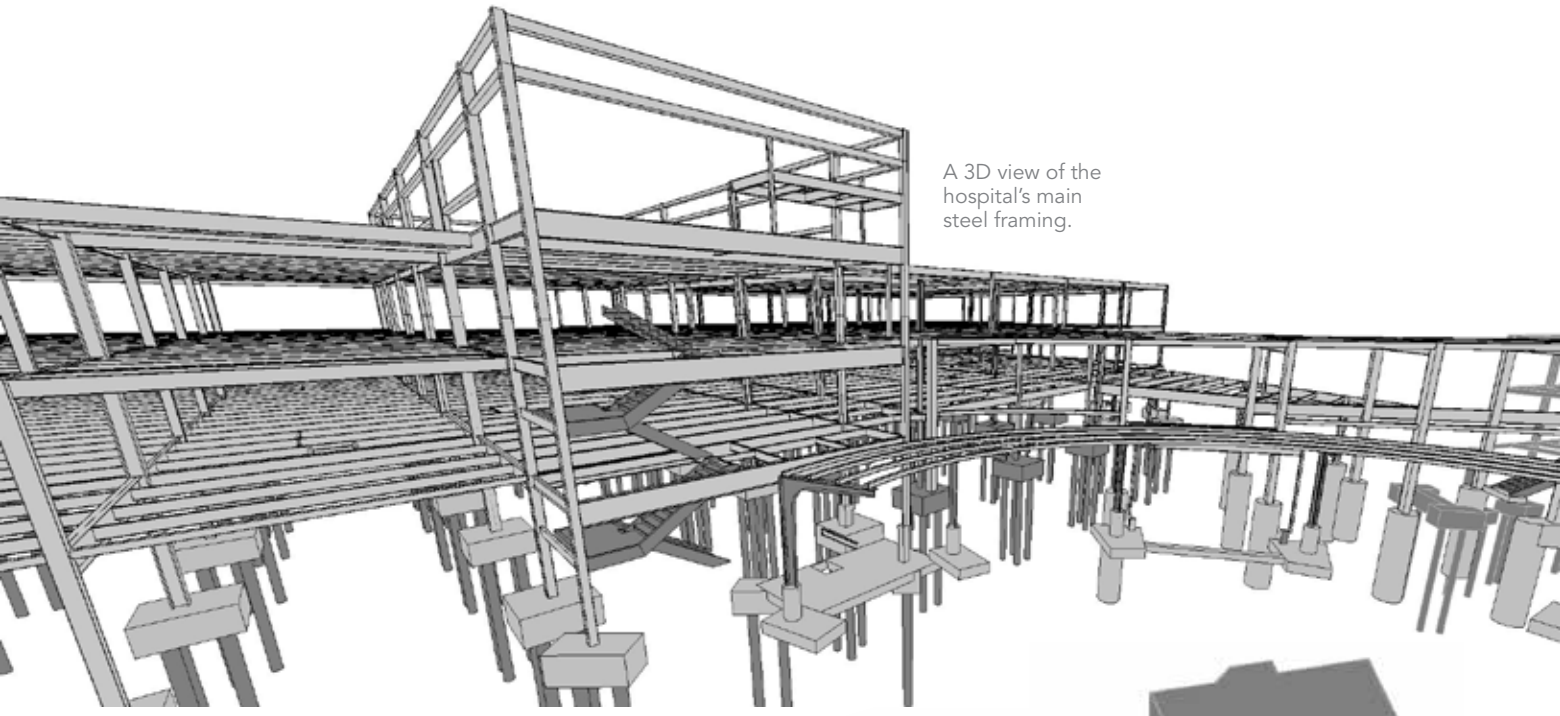
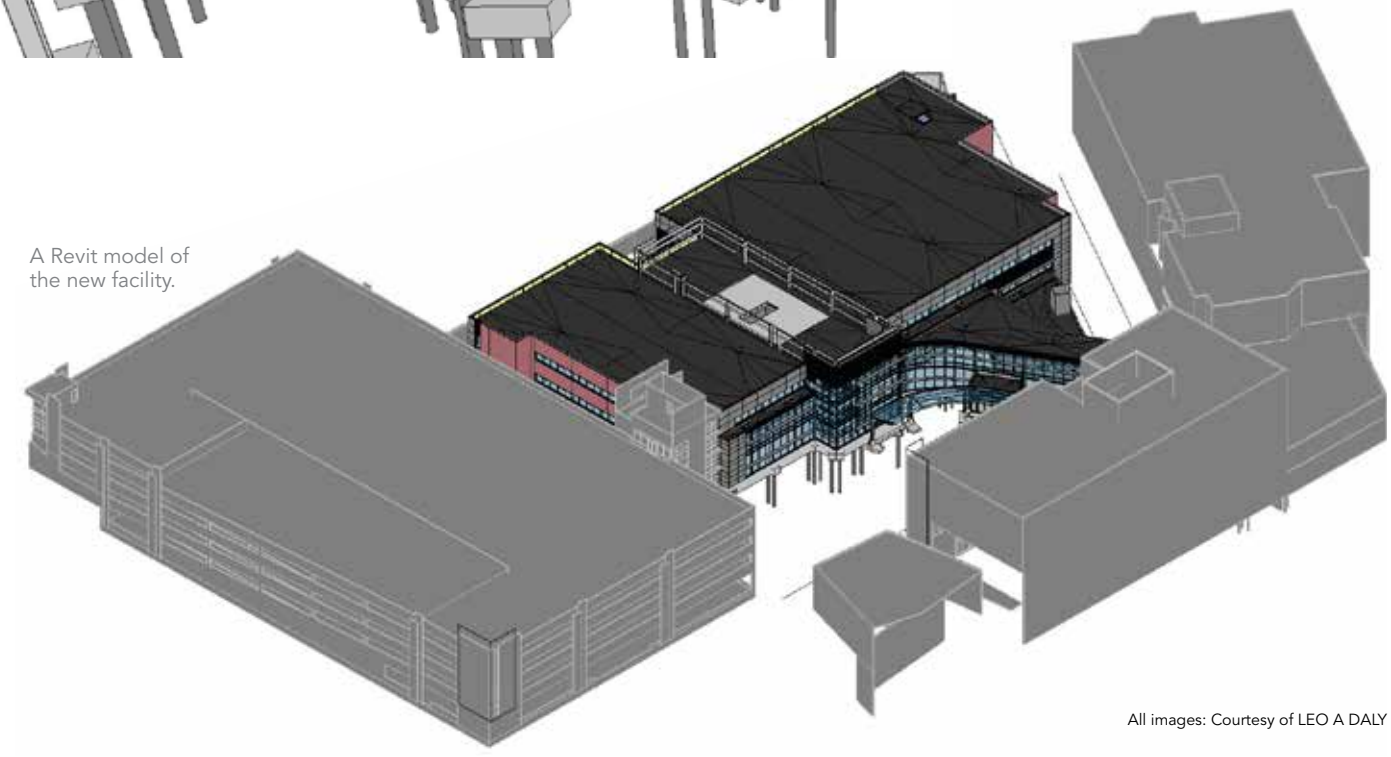
Intensified Care

BY RYAN CURTIS, PE

A steel solution aided in the successful completion of a complex healthcare campus renewal in Omaha.



A 3D view of the hospital's main steel framing.



A Revit model of the new facility.

All images: Courtesy of LEO A DALY

IN THE SUMMER OF 2017, CHI Health, a division of Catholic Health Initiatives, completed the extraordinary task of transforming its Bergan Mercy Campus into an innovative center of healthcare, serving Omaha and the surrounding communities with new and revamped state-of-the-art facilities.

With over 140,000-sq. ft of new construction and 250,000 sq. ft of renovated space, the campus is now named Creighton University Medical Center–Bergan Mercy. The $140 million project required relocating approximately 1,400 faculty and staff—no easy task for the design team. CHI Health turned to architect and structural LEO A DALY for a design solution that could address all of these numbers, and the firm subsequently turned to structural steel to facilitate the solution. General contractor JE Dunn estimated that the overall timeline of construction was reduced by approximately two to three months thanks to using a steel superstructure versus a cast-in-place concrete system.

The main stair of the connector building, with exposed steel stringers and treads.

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Erection of the connector building steel.

Schedule Benefits

With many moving parts, the construction schedule for the center's new Ambulatory Clinic was essential to all players of the design and construction teams, as well as the facility staff. Construction began in late 2015 and a summer 2017 ribbon-cutting was critical to allow the Creighton University Medical Program to move into the newly renovated and constructed spaces within a time slot bookended by the end of the spring semester and start of the fall semester. Simultaneous to the Creighton medical program relocating to the new campus, the Creighton University Medical Center hospital and clinics, located in downtown Omaha, also needed to be vacated and relocated to the new campus, including patients, staff and services.

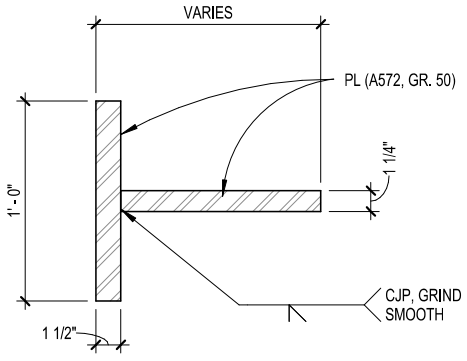
Healthcare services within the new ambulatory clinic include, but are not limited to, 136 exam and procedure rooms, two general X-ray rooms, 10 specialty procedure rooms and seven ultrasound rooms. Renovations of the existing spaces included updated surgery and post anesthesia care unit (PACU), a new 52-bed intensive care unit (ICU), a hospital laboratory and a fully renovated emergency and trauma department, making the medical facility only one of two Level-1 trauma centers in Omaha, capable of serving up to 2,000 trauma cases per year. Complementing the Level-1 trauma center is a newly constructed four-bay ambulance garage.

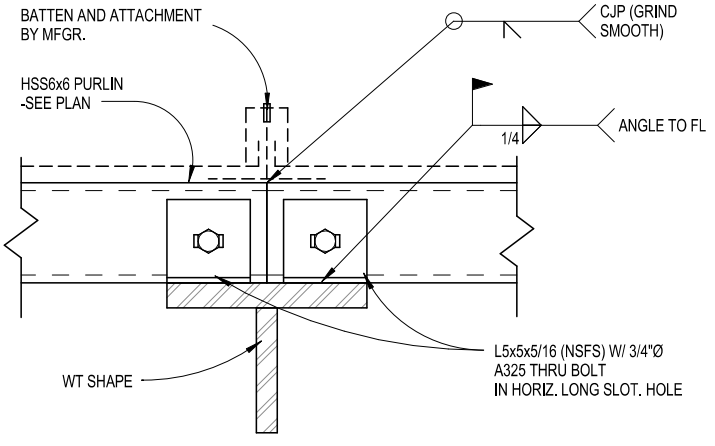
Exposure

Early in the design phase, LEO A DALY architects decided to showcase many structural steel members within the newly constructed spaces. Although not targeting any specific AISC architecturally exposed structural steel (AESS) requirements, the steel members met interior painting specifications for priming and final top colored field applied coatings. The large two-story volume connecting structure between the new ambulatory clinic and existing medical office buildings exposed vertical hollow structural steel (HSS) columns and HSS horizontal girts. These visible members accepted load collected by the ex-

left: Steel trauma room equipment support.

below: Details for the canopy.





above: Framing for the entrance canopy.

right: The canopy includes six column locations spread along an approximate 52-ft radius.

terior two-story curtain wall. The monumental stair that connects the ground level to the second level medical university also exposes the structural HSS stringers and treads. The exposed stair structure coupled with the exposed exterior wall columns and wind girts expresses the steel as a positive design feature in this highly used and visible grand volume space.

An additional unique design aspect included the main front-entry drop-off canopy. This canopy includes six column locations spread along an approximate 52-ft radius. The canopy column members are constructed as built-up Grade 50 1½-in.-thick flange and web plates. The web members geometry contains an additional radius where the column transitions into a horizontal cantilevered "beam" component. Welds performed in the fabricator's shop for the built-up canopy members were ground smooth at all complete joint penetration (CJP) connections.

The HSS purlins that support the architectural cover are curved along the canopy's entire length to meet the plan radius requirements set forth by the vertical column elements. All of the steel members at the main canopy are subject to 100% exposure to the extreme temperature swings of the Midwest climate (e.g., Omaha recorded a 70° temperature swing over a three-day period in 2014). Due to these temperate changes, the connections of the purlins to the built up canted beams accounted for thermal movement by use of horizontal slotted holes with thru bolts to angles bearing on top of the beam flanges. To resist the risk of corrosion, all of the canopy steel members received a high performance coating with an approximate 3-mil zinc-rich primer. This three-part coating system also used a secondary coating and final top coating to provide color to meet the architect's design.

A bay in the fully renovated trauma department.

Large mechanical units are located towards the center of the new clinic building rooftop. The architectural desire was to screen these large pieces of equipment from public view at ground level. The resultant approach included extending building columns vertically from the roof level and installing horizontal HSS girts spanning between these column projections. The exposed HSS members received a hot-dipped galvanized coating for protection from the elements, and a perforated aluminum screen wall spans between the galvanized HSS girts to serve as the visual barrier for patients and staff.

Long Spans

Typical construction of the new ambulatory clinic consisted of wide-flange beams and columns and concrete-filled metal floor deck. This framing system at various locations in the ambulatory clinic required long-span steel members—several at 45 ft long—to accommodate uninterrupted architectural program spaces within the floor plan. One particular area in the ambulatory clinic necessitating an open plan is the teaching conference rooms that provide over 4,000 sq. ft of contiguous space. This large footprint is located at ground level and is achieved structurally by using dual W40 transfer girders to accept column loading from the floor levels above. The levels above these conference rooms have more traditional 30-ft by 30-ft column bay spacing.

At the four-bay ambulance garage, open-web LH trusses spanned more than 65 ft to allow the ambulances free movement about the garage without any column interruptions. The ambulance garage was a necessity for the campus to achieve Level-1 Trauma center criteria.

Existing Construction

With fully renovated emergency, trauma, procedure and examination rooms throughout the existing facility, structural steel was the go-to option to allow attachments of critical medical equipment to above ceiling floor and roof construction. Overhead construction in these medical rooms varied from structural steel, concrete joist and flat slab construction with drop panels, based on the program scope of the various areas.

An overhead view of the medical complex, with the site of the expanded facility indicated by the red arrow.

In addition to various existing structural systems, mechanical, electrical, plumbing and fire protection runs were scattered about the above ceiling space, often interrupting the ability to hang any particular medical equipment mounting plate to direct overhead structural supporting system. This was also the case at the new trauma bay, which necessitated dual equipment booms and lights above each patient bed. Due to a large in-place mechanical duct run, the challenge at this condition was to provide vertical HSS posts and an HSS sub-framing system with equipment mounting plates below the ductwork. This "inverted table" solution allowed the planned medical spaces and equipment geometrical constraints to not be altered or compromised in any manner, and the steel framing avoided any clashes with existing utilities.

The success of this new CHI Health facility was predicated by meeting a flurry of demands, and the schedule was met largely in part by the speed and flexibility of the structural steel framing system. The exposed steel at the main canopy and connector building provided visual attractiveness, and the use of various steel components to attach the complex medical equipment devices to a multitude of in-place structural systems allowed healthcare services to remain as planned and available to the hospital's medical staff. ■

Owner
CHI Health

General Contractor
JE DUNN, Omaha

Architect and Structural Engineer
LEO A DALY, Omaha

Steel Team

Fabricator and Detailer
Katelman Steel, Council Bluffs, Iowa

Erector
Topping Out, Inc. (Davis Steel Erection), Omaha

Bender-Roller
Chicago Metal Rolled Products, Chicago