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MSC
MODERN STEEL CONSTRUCTION

Expanding in the Middle

How a big addition got built on a very tight site.

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Expansion is Cut to Fit

BY MATTHEW GOMEZ, P.E., S.E.

EVERY CONSTRUCTION PROJECT has its challenges, as any engineer and contractor will attest. But some, such as the Seton Women's Center in Austin, Texas, stand unique in their complexity.

The overriding challenge was that there was only one open space available on the 20-acre campus. That meant the new Women's Center had to be carefully squeezed into the opening between the existing nine-story Seton Medical Center hospital and an adjacent medical office building.

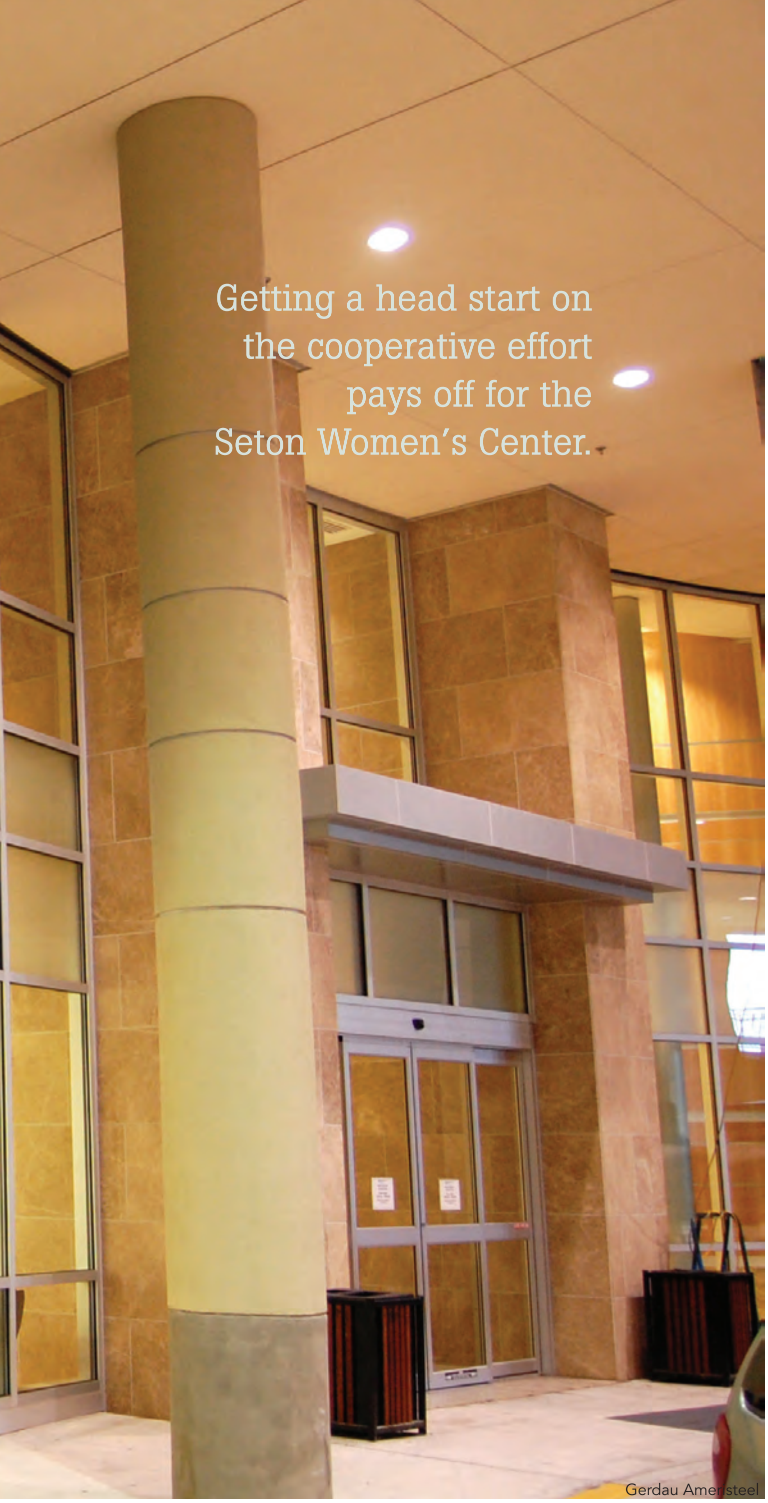
"This six-floor, 128,000-sq.-ft addition is shoehorned between two existing facilities," said Dan Vickers, an architect and project manager for Seton Network Facilities. "The existing facilities are askew to the city grid. The new addition matched the city grid, which led to skewed connections at the interface point with the Women's Center. This was the only solution within our master plan to accommodate the need for growth, given the previous additions to the campus."

But solving the geometric part of the puzzle was only the first part of the solution. Complicating the construction project was the requirement that the adjacent hospital remain open as a 24-hour facility, including ambulance and helicopter traffic, which demanded critical construction scheduling and reduced construction work areas on premises.

Capping the list of project challenges was a design that called for the Women's Center to cantilever 85 ft over the two-story Emergency Services department on the southwest corner of the Medical Center.

Facing these unique construction considerations, the general contractor understood that it was critical to engage in early discussions with specialty subcontractors for material procurement, fabrication and erection of the steel superstructure.

Getting a head start on the cooperative effort pays off for the Seton Women's Center.



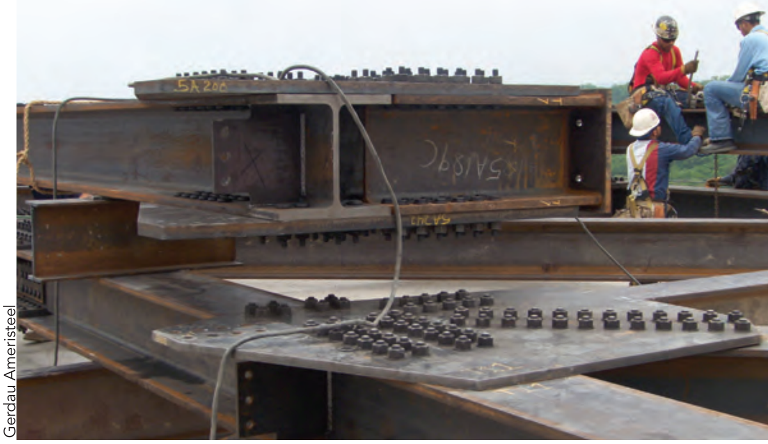
Gerdau Ameristeel

A new entrance and lobby in the existing hospital was constructed, accessed by a driveway below the Women's Center addition.

The answer was to use a program called Fast-Frame offered by Gerdau Ameristeel. The program brought together a steel mill, a steel fabricator, a connection engineer, and a steel erector, all of whom were allowed to work closely with the Engineer of Record.

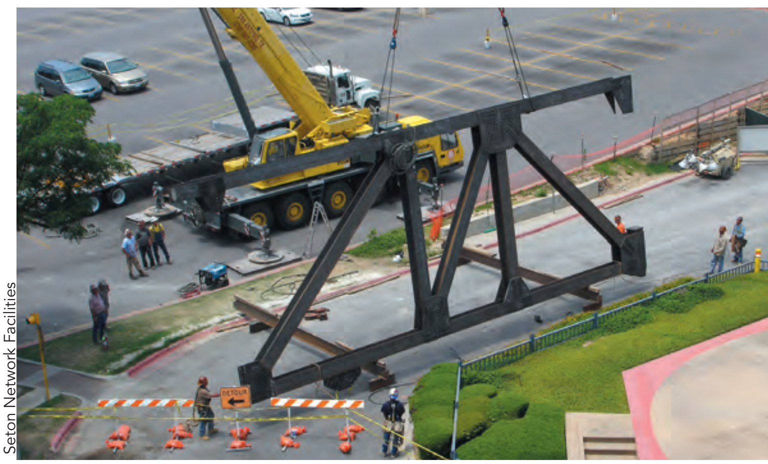
The philosophy behind the Fast-Frame approach is simple: Bring in the specialty steel contractor team in a design-assist role as early as possible to evaluate ways to optimize the cost and schedule of the delivered steel structure, and to address project specific goals. Because the program is led by the steel producer, the team is able to ensure optimal material selection, with guaranteed material pricing for the duration of the project, and on time delivery of material to the fabricator.

The integrated team examines trade-offs between material costs, fabrication labor costs and field labor costs. Each project brings a differ-



Gerdau Ameristeel

Cantilevered trusses were assembled and stacked with dunnage on the fifth floor of the building during construction. Pictured are ironworkers from Deem Steel Erectors.



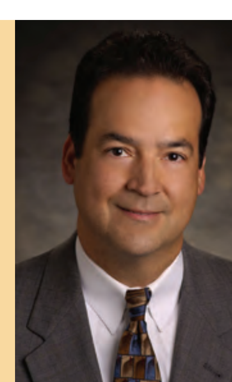
Seton Network Facilities

Cranes lift one of two trusses into position after assembly on the fifth floor of the Women's Center during construction. The two cantilevered trusses connected to create the southeast corner of the new building, with three levels of framing hanging below the trusses.

Rogers-O'Brien Construction

Ironworkers in personnel lifts guide the south wall truss into position. Note the back gusset plate already in position on the column at left, facilitating the bolt-up connection.

Matthew Gomez, P.E., S.E., is the Gerdau Ameristeel Fast-Frame National Sales Manager. The company is the second largest mini-mill steel producer in North America, with annual manufacturing capacity of approximately 12 million tons of mill finished steel products. Through its vertically integrated network of mini-mills, scrap recycling facilities, and downstream operations, Gerdau Ameristeel serves customers throughout the U.S. and Canada.



Thwarting Murphy's Law

It was critical that construction of the Seton Women's Center project go smoothly, especially given the need for the existing facilities to remain open 24/7. And from the participants' perspective, building an integrated, committed team—incorporating the steel mill, fabricator, detailer and connection engineer—very early in the process was a huge step in the right direction.

"The integrated project team made this project successful," said Greg Griffin, project manager for general contractor Rogers-O'Brien. "The complexities of this project were such that early involvement of the steel team helped solve a lot of issues."

Architect Dan Vickers, Seton Network Facilities' project manager, summed up his impressions of the project delivery team with high praise. "I like establishing relationships with good companies you trust," Vickers said. "Despite the proximity of existing facilities and other hidden conditions, the construction of the Women's Center was very successful. We brought in this team for their expertise and they delivered a great project."

ent set of challenges and criteria (e.g., site conditions, project schedule, budget constraints, BIM enabled capability, LEED accreditation, etc.) that requires a unique solution.

Early in the design process, and prior to award, the steel team was asked to review the Women's Center progress drawings to provide suggestions for improvement. Because the design was still in development, many of the design and constructability issues were still on the table for discussion. That allowed the team to offer alternate solutions that had minimal impact on design and maximum impact on cost savings. An initial budget was developed and submitted to the general contractor for evaluation, and a target was set for developing value engineering options.

The first area targeted for optimization dealt with the construction of the two major trusses that would be used to support the cantilevered southeast corner of the building. The original design used wide-flange sections as the top and bottom truss chords, with HSS sections for the vertical and diagonal members.

"There can often be a big difference between how it looks on paper and how it's fabricated, delivered and erected," said Greg Griffin, project manager for general contractor Rogers-O'Brien. "An integrated team brings into the picture all of the professionals who know best how the project comes together properly."

One example involved the truss design. "The engineer determined the truss configuration and load requirements," Griffin said, "then the steel team came in with new designs for the trusses and connections."

The connections originally were envisioned as gusset plates, shop welded to the wide-flange members and field welded into notched ends of the HSS members, which required a significant amount of shop time. Lastly, the truss members would be field-assembled and welded into place. However, because of the tight site conditions, the field assembly had to be done within a short period of time.

"It was a tight fit on the construction site, which made scheduling and sequencing of material delivery very important," said Denny Dinsmore, Rogers-O'Brien's senior field superintendent. "There was no room on the campus to store material. We needed a sequence that allowed us to handle each piece a minimum amount of times."

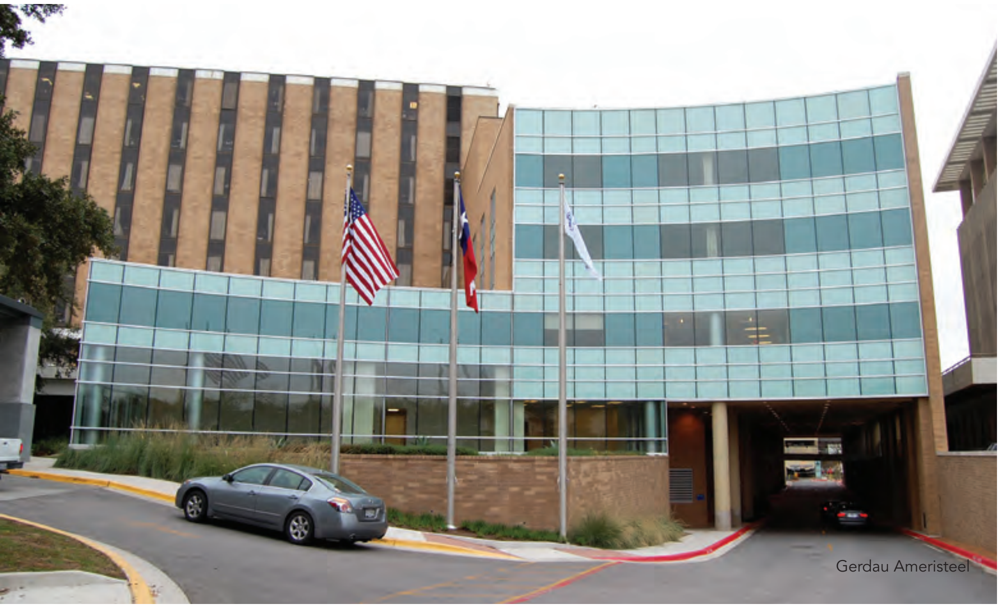
The alternative design solution offered by the integrated team was to use W-shapes for all members, and all of similar depth to simplify connections. Connection would be made with bolted side plates on either side of the cord faces. The trusses would be shop-assembled to ensure fit-up, then broken down for transportation, and finally bolted together at the site.

The initial drawback to this option was that these members were slightly heavier than the initial HSS equivalent; however the unit cost of the W-shapes was significantly lower at the time of procurement than that of the HSS shapes, resulting in a minimal differential in material cost.

A key advantage of the alternative design option was that it significantly reduced the labor time (and thus cost) for both shop fabrication and field erection. Adopting the alternative solution allowed a majority of the fabrication to be performed by computer numerically controlled (CNC) equipment. Members were cut and drilled using CNC beam lines, and the gusset plates were cut and drilled using a CNC plasma table.

As the design progressed it became clear that the space and time available to shake-out and assemble the two trusses at grade level would be even more limited than first anticipated. As a result, the team decided to assemble the trusses on the fifth floor of the building, one atop the other. That required significant coordination among the fabricator, erector and connection engineer to coordinate support points and to ensure that the floor members and their connections were adequate to support the added weight of the trusses as well as to maintain truss stability during erection.

This same strategy also was applied to the design of the vertical brace frames, changing the braces from HSS members to wide-flange members, resulting in additional savings in cost and field erection time. In this case, connections would be made using bolted connections with claw angles on the flanges and side plates on the webs to transfer axial loads. As with the trusses, that significantly reduced the labor time (and thus cost) for both shop fabrication and field erection. The members were cut and drilled using CNC beam lines, the claw angles were cut and drilled using a CNC angle master, and the gusset plates were cut and drilled using a CNC plasma table.



Gerdau Ameristeel

The completed Women's Center building, seen from the north, is defined by a silver/blue cladding. Below the building is a drive, accessing a new entrance to the hospital (to the left).

Other areas led to additional cost savings and schedule improvements, including:

- Reducing the number of column splices, which added weight but cut fabrication and erection time and costs.
- Revising work points where multiple members met at skewed connections, which improved constructability and reduced fabrication and erection time and costs.
- Revising the HSS support framing to be wide-flange beams for a pedestrian bridge that connects to the existing medical office building, with the same benefits as changing the trusses.
- Revising the floor framing to minimize the number of different member sizes in a typical bay. That allowed the detailer to simplify the shop drawings, reduced retooling in the shop, and simplified the erection planning. It also allowed the mill to provide material in bundle quantities and to nest the lengths more effectively, resulting in reduced waste.

"It was a team effort," Griffin said. "There are benefits when everyone comes together early, and throughout the project; it will more likely be a successful project, and we can give the owner the best value for the money."

And thanks to the integrated approach, the savings on this project can be quantified. By the end of construction, the integrated delivery team identified approximately $210,000 of value engineering savings for the $3.4 million steel portion of the project. MSC

Owner
Seton Healthcare Network, Austin, Texas

Architect
STG Architects, Austin, Texas

Structural Engineer
Datum Engineers, Austin, Texas (AISC Member)

Connection Engineer
Structural Solutions, Inc., Fort Worth, Texas (AISC Member)

Steel Erector
Deem Erectors, Longview, Texas (SEAA Member)

Steel Fabricator
Crist Industries Inc., Fort Worth, Texas (AISC Member)

General Contractor
Rogers – O'Brien Construction, Austin, Texas

Structural Software
SDS/2, RISA-3D, RAM Steel

Rogers-O'Brien Construction

Viewing the construction from the north, the southern wall truss in place and the crane is lifting the longer western truss into position.