Clinic's Cure

A medical clinic expansion crosses the bridge to health and healing.

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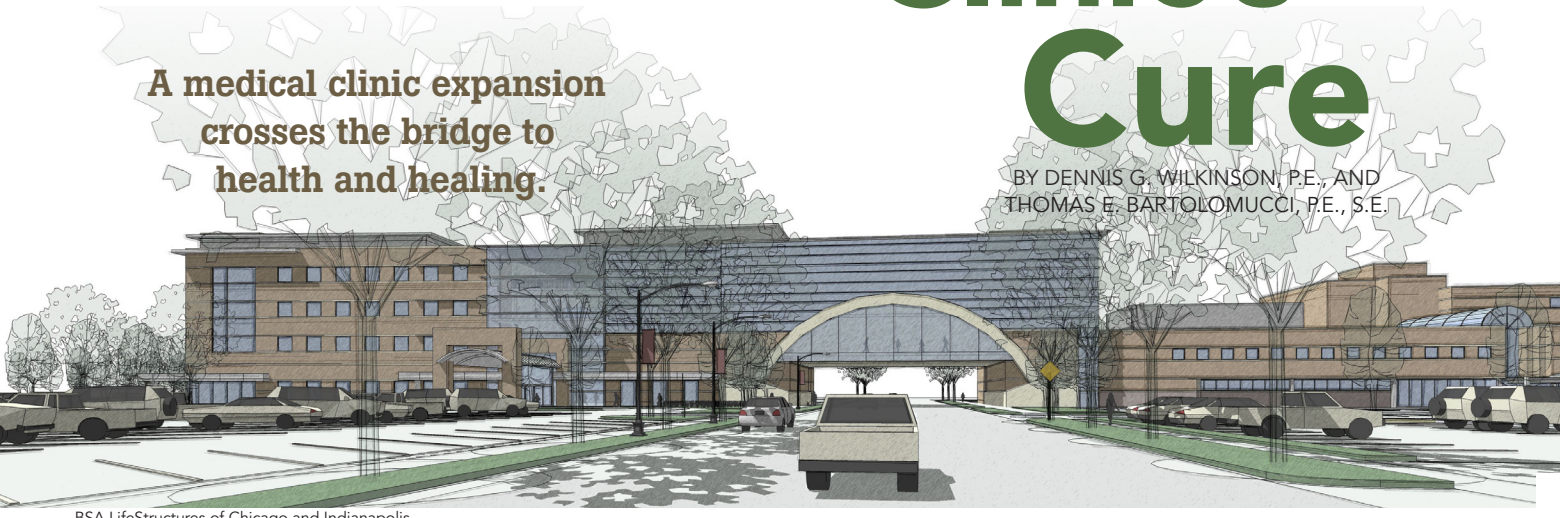

BSA LifeStructures of Chicago and Indianapolis

The design for the Springfield Clinic medical complex made use of limited real estate by incorporating offices, exam rooms, and patient waiting areas into a three-story, 15,000-sq.-ft air-rights bridge.

IN RECENT YEARS, AS demand for its medical services has increased and its number of physicians has tripled, Springfield Clinic LLP realized that an expansion to its current facilities was needed to better serve its patients and staff. As one of the 10 largest employers in Springfield, the clinic has 195 physicians and 70 nurse practitioners/physician assistants offering care in 40 medical specialty fields. It also has 20 offices located throughout Springfield and the surrounding communities.

With no additional room to expand on its site in downtown Springfield, the clinic purchased a site located to the west of the existing facility for its proposed 117,000-sq.-ft expansion. However, this site was by no means a blank canvas for the clinic's expansion and challenged both the clinic's and the design team's vision for the project.

The project team faced numerous challenges as the project unfolded, including demolishing several existing structures on the acquisition site, accommodating existing utilities, and minimizing disturbances to a privately-owned chiropractic clinic located in the shadow of the construction area—a mere 20 ft to the north.

Complicating the project further was a major city thoroughfare that split the new building site from the existing facility. This four-lane artery transports tens of thousands of motorists to Springfield's downtown and north end daily. Additionally, the design and construction team was charged with minimizing disruptions to the clinic's patients and staff, since the clinic continued to provide essential medical services, including operating its MRI and nuclear medicine facility, as construction progressed.

Design

While the clinic had purchased a site located one block west of its original facility, it envisioned connecting its current medical facility with its new building via an air-rights bridge. While structurally feasible, the project team first had to clear several hurdles, including obtaining approval from the city of Springfield to build over a major roadway, securing air rights for the bridge, and meeting city zoning requirements.

Working with a $30.6 million construction budget, the structural engineers developed the structural framework for the expansion—a 117,000-sq.-ft, four-story structural-steel-framed building with a partial basement. The centerpiece of the facility's design is a 15,000-sq.-ft, three-story air-rights office area that spans Springfield's busy four-lane Sixth Street and connects the new expansion to the clinic's original facility.

The structural design was driven by an aggressive 21-month design and construction schedule. By incorporating structural steel into the facility's framework, the project team could forge ahead with design, fabrication, and construction and meet the client's required time frame for opening its new complex in August 2008.

The structural engineers used Autodesk's Revit Structure to design and draft the steel mill order construction documents, and also used RISA Building System to perform structural analysis. Engineers quickly accomplished the design and placed a steel mill order only six weeks after the structural design began. This quick turnaround was followed by the completion of foundation construction documents in three months and completion of the final structural construction documents in five months.

Choosing a Structural System

Several systems were considered for the bridge structure before the project team selected long-span composite bar joists. The composite bar joists provided a redundant structural system to protect against disproportionate collapse if a vehicle impact occurred. They also offered a relatively simple erection sequence that minimized the disruption to motorists traveling through the construction zone into downtown Springfield. Engineers designed the long-span structure to minimize the vibration frequency and amplitude, taking into consideration the impact on the clinic's exam and waiting rooms located on the bridge structure. Floor vibrations were analyzed using Structural Engineers, Inc.'s FLOORVIBE.

Additionally, the engineers analyzed the lateral framing system using Revit and RISA to quickly model several different

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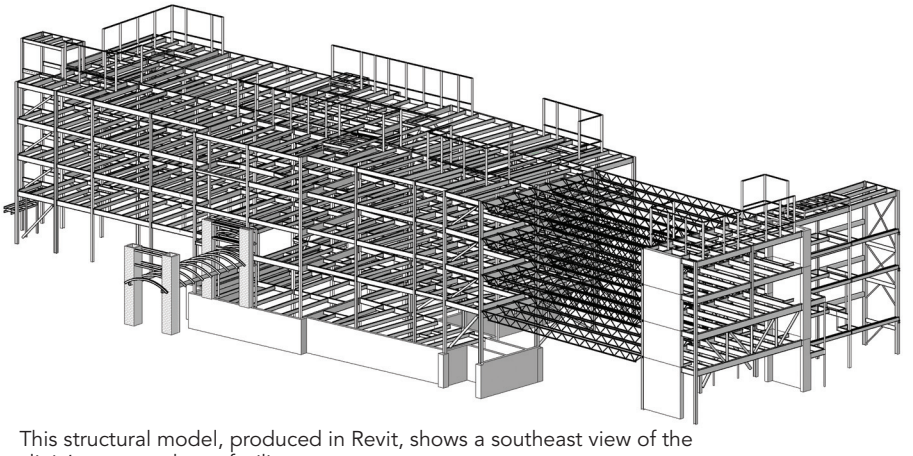

This structural model, produced in Revit, shows a southeast view of the clinic's proposed new facility.

The structural design for this expansion project was driven by an aggressive 21-month design and construction schedule.

Images: Hanson Professional Services, Inc.

framing and bracing scenarios before they selected the final arrangement of lateral bracing and composite-floor framing. Lateral bracing for the facility included steel tube struts, x-bracing, and chevron bracing on the western portion of the facility, combined with two large concrete shear walls, diagonal steel x-bracing, and chevron bracing on the eastern portion of the facility. Bracing connections were designed using Omnitech Associates' Descon Brace software.

The engineers were also challenged with arranging the structural steel members, including the facility's stairwells and elevators, around an existing magnetic resonance imaging (MRI) machine to avoid Gauss field interference.

Collectively, the project team regularly monitored steel pricing and availability to help select readily available and cost-effective steel members. The final structural system consisted of 1,193 structural steel elements, including beams, columns, and bracing, with a total weight of approximately 810 tons.

Reckoning with Magnetic Forces

The clinic's existing MRI facility required that the structure at the east end of the expansion support three floors, the roof, and an air handler while providing a clear span of 60 ft over the MRI. The initial design included steel plate girders at each floor level. Engineers and the steel fabricator then determined that a 14-ft-deep truss could provide a more efficient design. The story truss optimized the use of structural steel framing over the MRI, minimizing the potential effects of Gauss field interference, and provided an estimated cost savings of $200,000 over the steel plate girder design option.

Planning the Façade

The building's exterior façade used brick with punched windows, curtain walls, and deep rib metal panels. Lateral attachment for the curtain walls was provided at slab edges using continuous ⅜-in. bent plate attached to the top flange of the spandrel beams and welded rebar dowels, which developed the plate into the concrete slab. The continuous bent plate reduced the need for coordination with the curtain wall manufacturer, allowing the erection of steel and casting of floor slabs prior to a final architectural layout of curtain wall mullions.

For the air-rights bridge, the exterior façade consisted of a curtain wall with an integral limestone arch supported from

three-story-tall structural mullions. A non-continuous bent plate system, similar to the building curtain wall support plates, was used to support the curtain wall mullions from the bridge's perimeter roof joists. Hanging the curtain wall from the roof structure minimized the vertical movement under applied live loading and eliminated the need for expansion joints between levels. The use of continuous curtain wall mullions allowed the limestone arch to be supported from the mullions. Limestone veneer panels were used to create the arch within the bridge façade because of their light weight and identical final appearance when compared to traditional limestone masonry.

Structuring Success

The strengthening of an already strong working relationship between the design and construction team was instrumental in the successful completion of this project. Having past working experience with all parties involved provided a positive work environment and was conducive to providing efficient, well-coordinated designs. The use of technology also played an important role by providing the flexibility to handle modifications to the project, with integrated analysis and drawing production, within project deadlines.

Structural steel shop drawing review was streamlined using Design Data's SDS/2 Global Review Station. Global Review allowed the steel fabricator to share the steel detailing model with the design team. The model acted as a powerful communication tool between the fabricator and the design team, and it also eliminated the need for the standard transfer of hard copy shop drawings.

After enduring an intensive schedule, vertical and horizontal design challenges, and site considerations, the Springfield Clinic project team persevered, completing a major medical complex for Springfield Clinic on schedule. In Illinois' capital city, a place where history blends with modern-day life, a substantial new medical complex graces the skyline, serving as a gateway to health, healing, and vitality. MSC

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Engineering Software
Revit Structure
RISA Building System
AutoCAD
FLOORVIBE
Descon Brace