Planning to Grow

By Chad O'Donnell, P.E.

The one-of-kind architecture of this northern Wisconsin health care facility came to life with the flexible framing options of structural steel.

Courtesy Hammel, Green and Abrahamson, Inc.

Saint Mary's Hospital is a $46 million, 44-acre integrated health care campus that provides a full range of diagnostic, testing, laboratory, inpatient, outpatient, and emergency services. Unique elements, made possible by the strength and flexibility of structural steel, help give the hospital a distinctive look while maintaining the main goal of providing high quality patient care.

Completed in spring 2004, the 242,000 sq. ft facility includes a three-level, 71-bed hospital; a two-story outpatient clinic; and a single-story emergency department—all linked by a central diagnostic and testing area and other shared facilities. The facility was designed to accommodate future growth needs, both horizontally and vertically, with minimal expense and disruption of ongoing hospital services.

System Selection

During the schematic design phase, Hammel, Green and Abrahamson, Inc. (HGA), provided comprehensive architectural and engineering services. HGA worked closely with the general contractor and the construction manager to determine the most cost effective framing system for the project. The two systems considered for this project were a structural steel frame with composite floor slabs and a wide-module concrete pan and joist system. Steel proved to be the logical choice for a variety of reasons, including its speed of erection and structural flexibility.

Schedule was an important consideration for this project. The facility is located in northern Wisconsin, where summers are short and brutally cold weather can sometimes hamper construction activities for a good portion of the year. Avoiding winter construction would not have been feasible for a project this size, so the goal of the construction team was to enclose the building as fast as possible. Steel had a much faster erection time than concrete, allowing other trades to start their tasks earlier. This led to faster completion of the building enclosure and resulted in overall cost savings for the project.

Geometry was another important consideration in choosing the framing system. The Saint Mary's project features many curves and angles, and a "typical" bay does not really exist. The non-standard geometries would have led to many custom forms for a concrete frame and would have driven up the cost of a concrete system.

Finally, future flexibility was paramount—renovations in a hospital are a fact of life. Medical technology is always advancing and new equipment is often heavier than the equipment it is replacing, resulting in additional loads to the existing framing system. Projects of this size are also subject to many design revisions after construction has started, meaning changes will be required in the

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field. While both concrete and steel framing systems would have been able to accommodate the addition of small floor penetrations, a steel frame more easily accommodated floor reinforcement to handle the extra weight of medical records files and framing modifications for new ductwork.

Drive-Up Canopies

The first element patients encounter when arriving at the Saint Mary's campus are exposed steel drive-up canopies. One serves the inpatient entry on the east side of the project; a second serves the outpatient and emergency department entries on the south side of the facility; and a third, smaller version serves the oncology entry on the west side of the campus. The canopies were designed to mimic the look of trees in the surrounding woods, with tube steel "branches" springing from "tree trunk" steel columns to support the exposed steel framing overhead.

The canopy roofs consist of 3" steel roof deck, exposed to view on the underside, attached to tapered W18x50 beams, and spaced about 10' on center. The beams are supported by HSS 8×8 struts that are welded to a stiffened plate on top of W12×87 steel columns at approximately 45 degree angles. This was a particularly challenging connection to detail because the forces in the struts at this point are large and roof drains and sprinkler piping are hidden within the struts at each column. In addition, lighting for the canopies is located between the struts, so plates were added to the connection to provide a mounting location for the lights. The columns are cantilevered off the foundations to resist lateral loads and are wrapped in round pre-cast concrete column covers to give them a finished appearance. All steel, except the columns, is exposed to view and was fabricated to meet the requirements of architecturally exposed structural steel. A high-performance paint system was used throughout the canopy to protect it from the weather.

Entry Lanterns

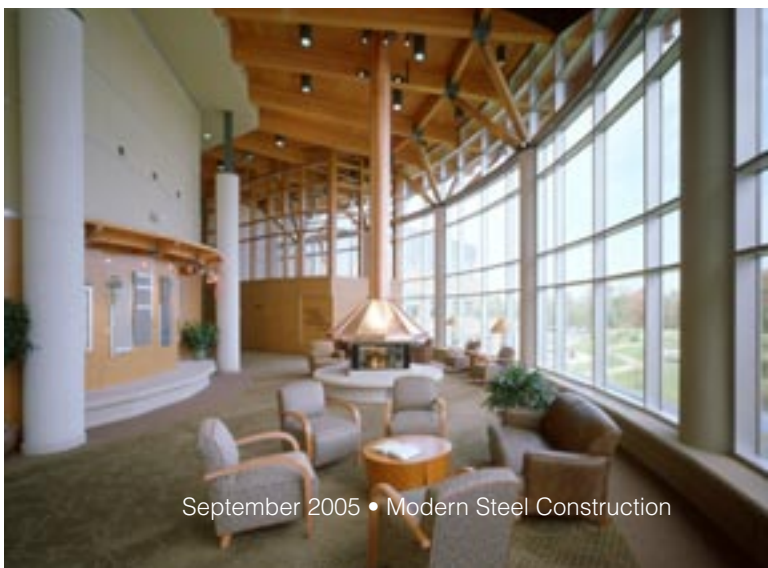
Three, two-story glass box entries serving inpatients, outpatients, and the emergency department comprise another distinctive element of the hospital. The large, all-glass entry pieces are designed to glow at night like lanterns to help patients find their way. They also serve as decorative elements that help give the hospital its distinctive northwoods aesthetic.

Much like the entry canopies, the entry lanterns are designed to mimic the look of the surrounding trees. However, unlike the canopies, the entry "branches" are made out of glue-laminated timbers, not HSS. The wide overhangs of the entries simply cantilever out from HSS 8×8 supporting columns in the plane of the exterior glass curtain wall. The diagonal struts serve purely aesthetic purposes. Like the canopies, the overhangs of the entries are framed with exposed steel beams, tapered to a depth of 6" at the ends. HSS 3×3s are used on top of each tapered beam to create a small space between the top flange and the bottom of the steel roof deck. This space is used to accommodate wood decking, which gives the overhangs the unique look of wood supported by steel. Albi Clad 800 intumescent paint was used on all exposed steel members to achieve the three-hour non-combustible fire rating required for the steel columns and the one and one-half hour non-combustible fire rating required for the roof structure.

Community Center

Situated at the intersection of the hospital's two main circulation spines, the Community Center is the project's signature ele-

This page: The extensive use of wood framing for the Community Center's roof required that it be structurally isolated from the rest of the hospital to meet fire code requirements. Photos courtesy Hammel, Green and Abrahamson, Inc.



The steel framing of the entrance canopies supports the roof deck with tree-like branches of HSS. Photo courtesy Hammel, Green and Abrahamson, Inc.

ment. The Community Center is a curved, 25′-tall space surrounded by glass that overlooks a large pond and a dense grove of trees. It is framed in wood and contains a custom-built copper fireplace giving patients, visitors, and staff the sense of being in a cabin.

To achieve the desired look of the space, HGA's designers wanted to use as much exposed wood framing as possible. This resulted in many challenges for the design team. Codes discourage the use of combustible material in a hospital for obvious reasons. In order to use wood framing and still meet the requirements of the code, the Community Center needed to be completely separated from the rest of the facility. This meant providing two-story fire doors at each end of the space to seal it off in the event of a fire. It also meant structurally isolating the space from the rest of the facility, which was easily done from a gravity perspective but did not leave many options for dealing with lateral loads. Because the roof is wood, moment frames were not an option, and the openness of the space precluded the use of bracing. This left cantilevered steel columns, buried in the glass, and an exterior curtain wall as the most logical choice.

Like the canopies and the entries, the Community Center framing is meant to resemble the surrounding trees. Seven W14×120 columns, oriented so the strong axis is perpendicular to the exterior wall, are cantilevered 18′ off the foundations to pick up the forces from four 6¾″×6¾″ glulam struts that support the wood roof framing above. The tops of the columns are tied together with curved HSS 6×6 members. This helps distribute the lateral loads between the columns and provides the stiffness necessary to support the glass walls. A second row of steel beams and columns along the interior side of the space picks up the other end of the roof beams. The result is a welcoming, light-filled space that serves as the center of activity for the facility. ★

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