

Structural Steel Creates A Healing Environment



An exposed structural system was integral to the architectural design of the Northwest Community Healthcare Wellness Center

By David E. Eckmann, AIA, S.E.

ONE OF THE NEWEST OBJECTIVES IN TODAY'S HEALTHCARE INDUSTRY is to support people in their desire to lead healthy and fulfilling lives. In order to achieve this goal, hospitals have begun developing facilities known as wellness centers. Wellness centers are facilities dedicated to the physical conditioning and strengthening of individuals on the hospital campus, as well as providing general fitness facilities for the surrounding community. Unlike most fitness centers, wellness centers include clinical components such as sports medicine and cardiac rehabilitation. The \$12.5 million Northwest Community Healthcare Wellness Center is a 85,000-sq.-ft. state-of-the-art facility that takes a unique approach to healthcare. The Center, located in Arlington Heights, IL, offers both fitness and medical programs, and provides motivation and self-challenge to assist people in their desire to pursue a healthy

lifestyle.

The client's design objective for this project was to create a wellness center that encourages a patient-focused healing environment for the surrounding community. The design for the facility was also to be self-promoting through its architectural expression. O'Donnell Wicklund Pigozzi and Peterson Architects, Incorporated (OWP&P), a full-service architectural and engineering firm with expertise in healthcare facilities, was awarded the challenge of designing and engineering the facility. The client's design objective was achieved through the open layout of the building, and the design of a three-story steel and glass spine which runs the entire length of the building. The design evokes an image of emotional and physical fitness, allowing daylight to flow into virtually all areas of the facility. All of the main spaces, including the basketball courts, 25-meter lap pool, elevated running track,



and the fitness area, are literally engulfed with daylight. Not only does the natural light inspire a feeling of nature and healing, but the extensive application of glass partitions provides for additional motivation as users continually view others actively engaged in exercise. In this way, this facility is unlike any other of its kind.

The use of structural steel was critical in the success of this project. Steel allowed a light-filled, open space to be created. No material was more appropriate, or cost effective, in creating this exciting volume of open space. The use of steel allowed larger bay sizes, smaller foundations, and faster erection than other systems that were investigated. Steel also allowed the flexibility for further expansion and plan modifications, another programmatic requirement of the client.

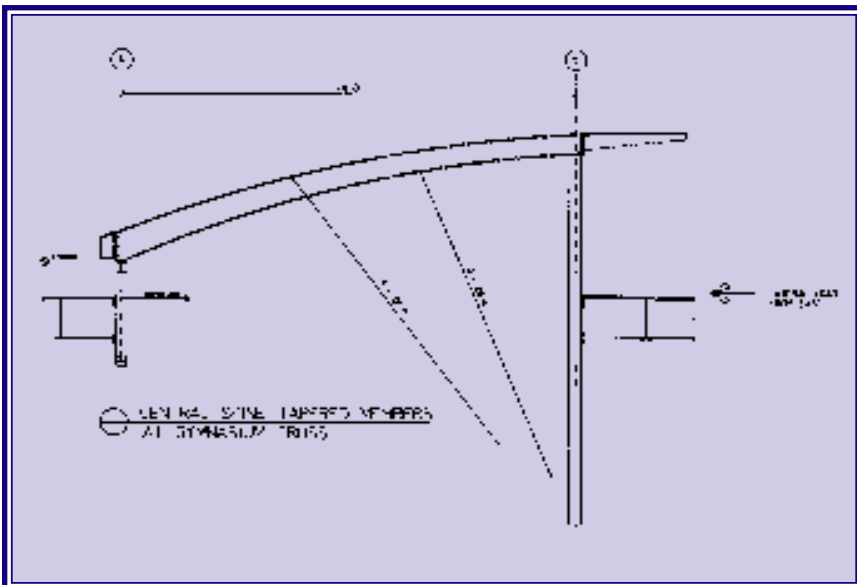


The Northwest Community Healthcare Wellness Center is designed to evoke an image of emotional and physical fitness, which is partially achieved through an open plan with extensive natural light. Photography by Paul Schlismann Photography



THE CENTRAL SPINE

The steel and glass spine, which extends the entire length of the building, is the primary architectural feature of the facility. The spine separates the clinical and fitness areas, and is enclosed by custom built-up steel beams, which are curved and tapered. The beams act as ribs that gracefully span 48' across the spine. The tapered beams are made from steel plates cut to the proper web profile, and flange plates which are bent to two different radii. The tapered members vary from 18" to 36" in depth. Long span metal deck (7½" deep) spans 24' between the tapered beams. The tapered members and long-span deck are painted and exposed to create the finished ceiling throughout the spine of the building. The structural framing concept for the spine is twofold. It not only expresses the desired architectural image for the building, but it also provides an economical framing solution. The 24' spacing of the tapered beams minimized the number of custom beams that need to be fabricated, and also eliminated several columns and footings. It also reduced the number of members to be erected. As a result, the total building cost was reduced, satisfying the owner's budget needs.



The architectural design of the spine created several structural challenges. One of the challenges was the design of the roof members at each end of the spine. The members at each end of the spine are tapered, and curve both vertically and horizontally. A finite element analysis provided the torsional design forces and member rotations for the proper design of the members. Erecting the doubly curved members at a slightly "upward" rotated angle allowed the members to "fall into plumb" once the superimposed dead load was added. This was critical in maintaining reasonable rotations and deflections of the dou-

bly curved members once the live load is added.

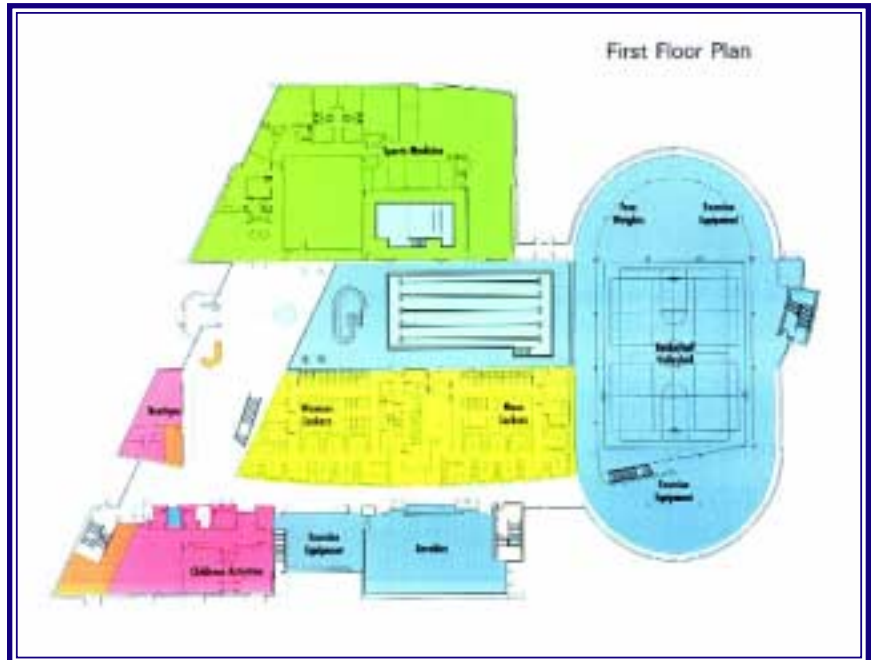
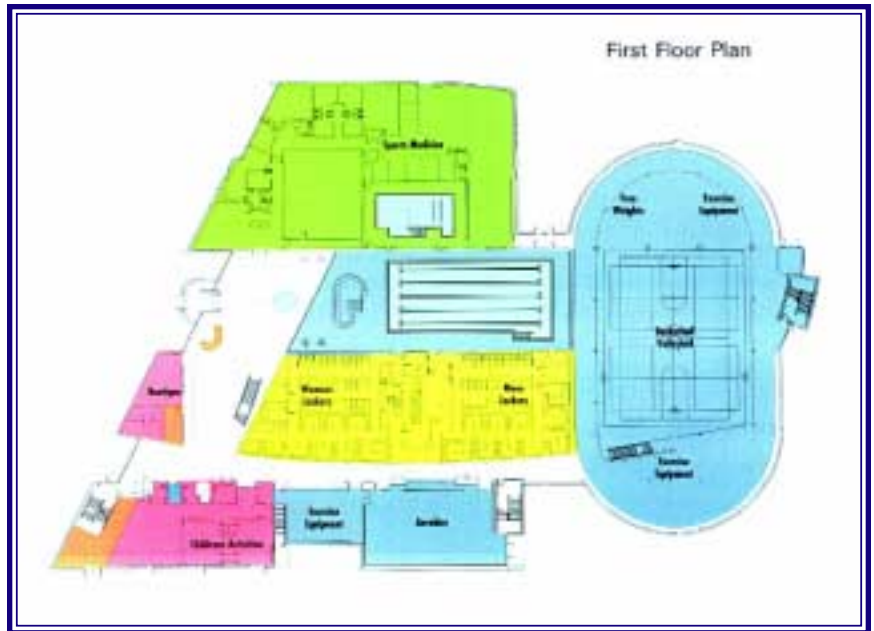
Another challenge was to minimize the horizontal movement of the three-story columns that support the central spine. The curvature of the spine's tapered framing members exerts an outward horizontal thrust at the tops of the columns. The columns, which have an unbraced length of over 20 feet were designed to cantilever up from the second floor framing. Increasing the column stiffness proved to be the most economical solution to limiting the horizontal displacement at the top of the column, and meet the curtain-wall manufacturer's requirements.

SUPERSTRUCTURE

In addition to the spine, the superstructure for the building is structural steel framing. The second floor framing and the expansion area above the sports medicine clinic were designed as composite steel framing with composite metal deck. In all cases, the LRFD method of design was incorporated. The roof framing at the gymnasium consists of steel joists, and a 7'-deep truss that spans 96' across the gym. The truss supports the central spine as it runs across the entire width of the gymnasium. All of the columns and rolled shapes for this project were specified as ASTM A572 Grade 50 steel. To meet the code fire requirements, the columns at the central spine were protected with insulating concrete and encased with non-load bearing seamless steel shells.

LATERAL SYSTEM

Since the building is physicaly divided by the open central spine, the building is split into two separate structures—each requiring its own lateral system. Early communication between the architects and structural engineers allowed the incorporation of an economical bracing solution of single-angle diagonal members. Each half of the build-



As shown in the floor plan, the building is essentially split into two structures by the open central spine. As a result, each portion of the building required its own lateral system.

Shown top right is the main entrance (photograph by Paul Schlismann Photography).

ing was designed with a diagonal bracing configuration (X-bracing, K-bracing, or eccentric bracing), which was coordinated with the door and window openings in that particular bay. The decision was made to express the X-bracing lateral system in the pool area. A circular connection plate was incorporated at the intersection of the braces to enhance the exposed steel bracing.

Even though the pool bracing was exposed, it still needed to maintain its code required fire rating. This requirement was achieved by painting the braces with a fire resistant intumescent paint. Intumescent paints are epoxy based paint-like mixtures applied to primed steel surfaces. When the temperature elevates, a gas component in the intumescent system is released and the product swells to several times its original thickness—creating an insulating blanket for the steel. Since the intumescent paint system is not an inexpensive solution, it was used only at the exposed bracing in the pool.

The 96' truss, which spans across the gymnasium, provides a column-free space below for the basketball and volleyball courts. However, the truss supported continuous spine destroys any possibility of a continuous diaphragm in the gymnasium roof plane. One of the challenges of the project was to find a way to transfer the horizontal loads in the roof diaphragm on the east side of the gymnasium across the spine and into the lateral resisting system on the west side of the spine. The solution involved forcing the load to flow through the curved beams of the central spine and, in turn, exert horizontal forces on the weak axis of the trusses' top chord. The horizontal forces are then resolved into a series of force couples created by the joist bridging which is connected to the truss. The load is then transferred into a three-dimensional truss, which spans horizontally at the roof level on the

west side of the gymnasium. The horizontal truss reactions are distributed to a masonry shear wall on one end, and to a diagonally braced steel frame on the other end of the truss.

MOISTURE IN BUILDINGS

The architectural design called for the central spine to be a curved plane and extends outside the building on each side of the spine. Therefore, special thermal breaks had to be designed into the steel framing connections to prevent condensation from forming inside the building. This was particularly critical at the pool area where a high moisture level is prevalent. The tapered curved beams at the pool were "broken" as they extended outside the building, perpendicular to the length of the spine. The "break" in the beams were filled with 1" shims and insulation, which prevented transmission of cold air into the warm, humid pool area. The built-up beams at each end of the spine also needed to be insulated at the exterior glass walls. Foaming an expansive insulation between double web plates in the built-up beams insulated these doubly curved beams. The double web members were originally intended only as an architectural element to enclose insulation in the members that are exposed from both sides of the beam. The double web configuration created a closed structural section that was then used to resist the torsional forces in the doubly curved members.

The Wellness Center at Northwest Community Healthcare has been well received. The project boasts an innovative structure that embraces the architectural design and is visually exciting. The project implements creative structural problem solving and is sympathetic to the budget needs of the client. With a mission to re-focus away from the incidence of illness, the Wellness Center is a major component in NWCH's effort to build on a continuum of wellness.

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Steel Detailer:	Universal Detailing, Inc., Lansing, MI