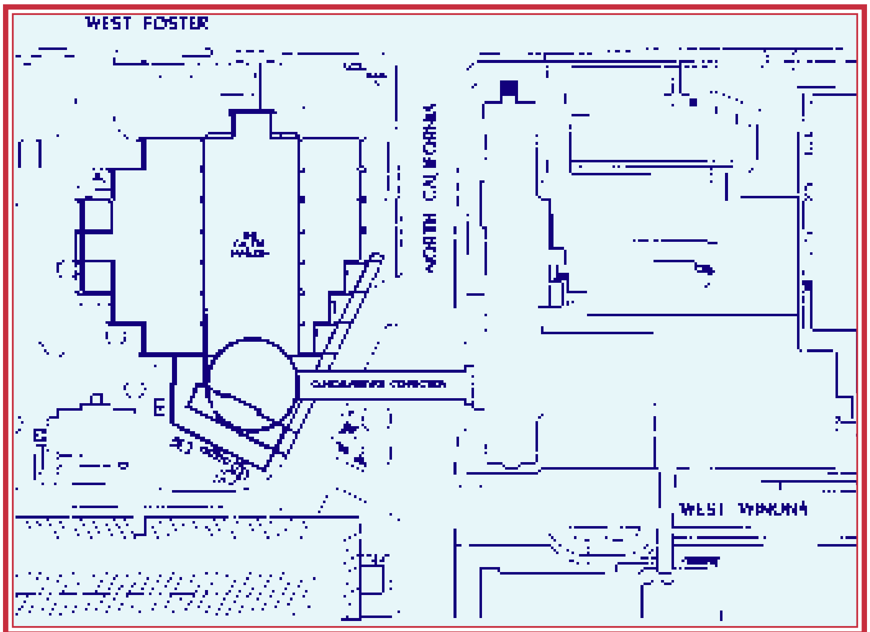
Expanding For The Future

Photo by Paul Schlismann



A pedestrian bridge was a critical element in connecting the main campus of Swedish Covenant Hospital in Chicago to a new building across a busy street

By Norman B. Golinkin, S.E.

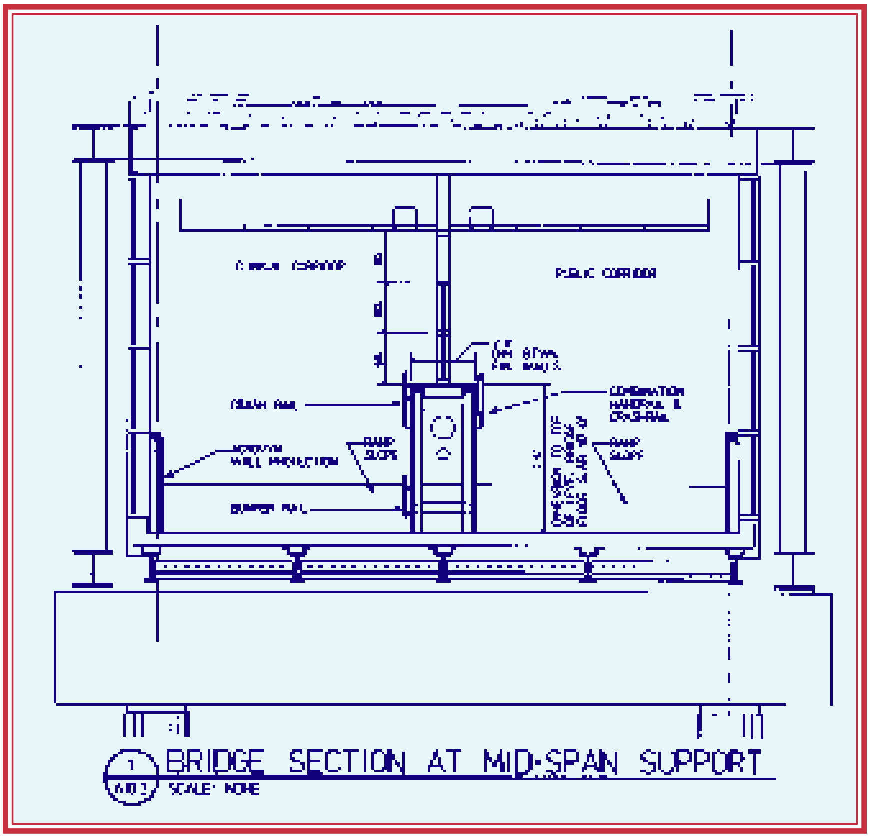
ON CHICAGO'S NORTH SIDE, A 140'-LONG PEDESTRIAN BRIDGE that runs east and west over a busy street buzzing with traffic serves as a gateway for visitors as they arrive at Swedish Covenant Hospital's campus. This $1.2 million bridge connects the hospital's main building with the new $45 million Jack and Dollie Galter Pavilion, a 7- story, 185,000-sq.-ft. building with a striking glass façade. With an exposed steel structure, the bridge is a physical, visual and symbolic link that the hospital has used to reintroduce itself to the community. For Swedish Covenant, the bridge conveys connections, safe passage and renewal. It has become synonymous with the hospital's mission of bringing health care services into the 21st century.

Beyond image building, the bridge serves equally important practical functions that are part of its overall design and planning. The client's objectives for the bridge included space for mechanical systems, facility for connection with a parking garage and a double corridor. The public side accommodates high volume traffic. The clinical side maintains patients' privacy. The design of this visually appealing bridge reflects creative solutions to meeting several architectural, engineering and logistical challenges.

In 1992, OWP&P (O'Donnell, Wicklund, Pigozzi and Peterson) Architects Inc., a full-service architecture and engineering firm in Chicago with expertise in health care facilities, was selected by the client to design a new ambulatory care facility that would meet the marketplace demand for more modern outpatient services. Galter Pavilion, which was built on existing green space across the street, houses inpatient and outpatient surgery, cancer treatment and family practice centers. Because patient rooms are located primarily in the main building, a route for transporting patients and supplies from Galter to the main hospital was required.

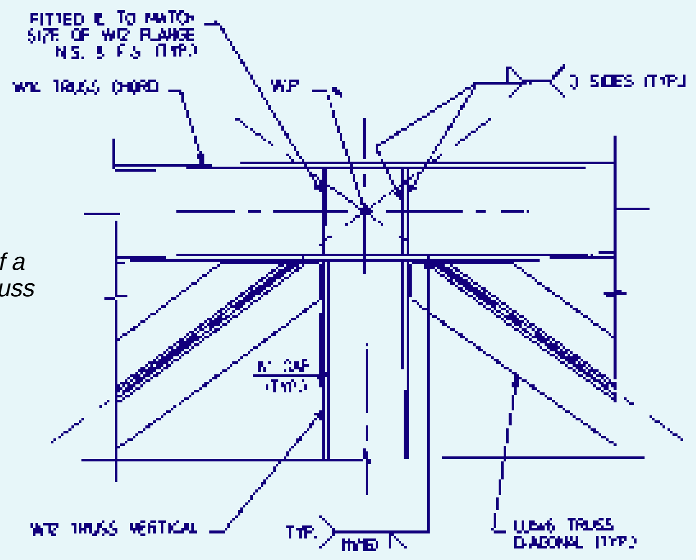
Several options for connecting the new and existing buildings were considered. Tunnels were not a viable alternative because major utilities beneath the street separating the two buildings would have needed to be relocated. Also, sandy soil conditions and a high water table at the site would have created design and construction complications, increasing project costs. Therefore, a bridge was considered the best option. Not only was this connection necessary for the new building to be functional, but it also supported the client's objectives of providing cost-effective, quality medical care.

The bridge connects the Pavilion's surgical center on the second floor with the lobby of South

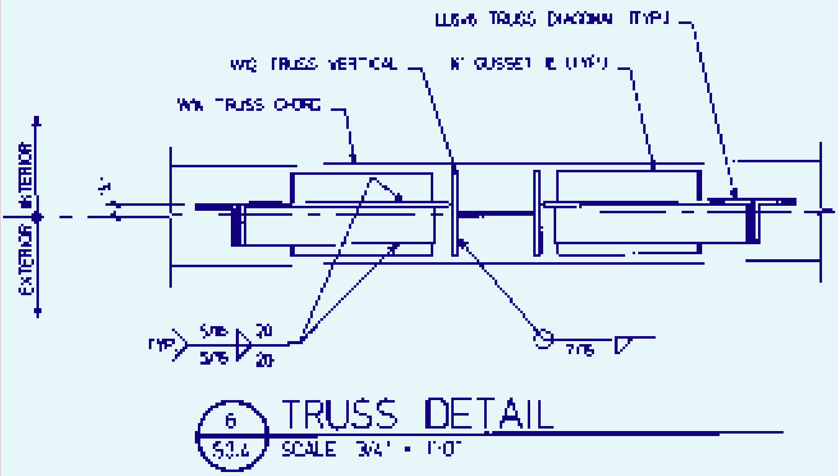


Shown is the section through the pedestrian bridge showing the steam line within the demising wall.

Wing on the third, which was remodeled during construction to include a gift shop and chapel. The bridge also was designed to attach with a future connection from an existing parking garage located south of the Galter Pavilion. But this pedestrian bridge is more than a transportation route. It houses mechanical systems including a steam line, pneumatic tubes, communica-



Detail of a typical truss joint.



tions and data links. The steam line, which runs through the bridge, provides power to the new building from an existing power plant. By linking the buildings and supporting cost-efficient mechanical systems, the bridge became an umbilical power cord—a lifeline between the existing hospital and the new building..

Choosing the best method for routing the large steam line proved to be a significant challenge. Placing the steam line on the roof structure or underneath it were two methods considered. Placing the line, an 18" diameter pipe, on the roof structure would have added extra costs and impacted the bridge design. Installing the line underneath the roof within the bridge space would have reduced headroom below an acceptable level. Since the client wanted a double corridor bridge, the project team determined it was most practical to enclose the steam line in a wall between the corridors.

Another major challenge during the design process involved balancing the client's objectives for a double corridor with the City of Chicago's demand for a transparent bridge. During the zoning approval process for the new ambulatory care facility, the City, citing a previous policy of not allowing pedestrian bridges over major streets, said it would not permit construction of this bridge over California Avenue, the street separating the two structures. Once it was demonstrated that the bridge was crucial to meet functional project requirements, the City agreed to allow it if the bridge structure was designed for maximum transparency.

The resulting compromise satisfied engineering as well as aesthetic concerns. Instead of a full-height wall separating the two corridors, only the lower portion of the partition was made opaque. Above that section, designers used a combination of translucent glass and open framework to preserve the effect of daylight passing through the bridge.

The bridge's exposed steel structure was comprised of a pair of continuous two-span trusses, each span an equal 70'. The trusses were spaced at 22' on center (originally designed at 18' feet, truss spacing was adjusted several times to accommodate architectural detailing of the two eight-foot wide corridors).

Like Galter Pavilion, the trusses were designed using the LRFD Specification and were fabricated of W14x90 chords and W12x87 verticals. Rather than use hollow structural sections, 6x6x⅝ double-angle diagonals with distinct edges were used to emphasize the bridge's structural elements. To accentuate the shape of the diagonals, members were rotated 90 degrees to make both angles visible from the exterior and to cast strong shadow lines.

On the roof, an 18 gage, 4½" long-span metal deck was placed over purlins framing into panel points spaced at 17'-6" on center. To resist lateral loads, horizontal trusses were located in the planes of the floor and roof framing. The "verticals" of these trusses were formed by W10x112 floor girders and the W14x43 roof purlins, respectively. Since in both cases these trusses would not be visible, TS4x4x3/8 hollow structural sections were selected for the diagonals. These horizontal trusses were designed to transfer the lateral loads into three moment frames located at the ends and midspan of the bridge.

The moment frames were made up of two W12x87 truss verticals and the floor girder and roof purlin that occur at those locations. To show the profile of the W-sections, the truss verticals were oriented with webs parallel to the bridge span. This required members with large weak-axis section properties for adequate strength and stiffness. Truss verticals were made the same size to provide a consistent visual appearance. Each of the moment frames was set upon a concrete pier made up of two 24" diameter columns and a 32" x 42" deep beam.

The bridge's foundation consists of two combined spread footings and an existing concrete grade beam that was part of the South Wing's existing foundation. The existing grade beam was reinforced by a new 14" x 60" grade beam parallel and adjacent to the existing one. The beams were then spliced together at the column locations via an assembly of steel plates adhesively anchored into the existing beam and embedded with headed shear studs into the new beam. The steel reinforcement of the concrete columns was then attached to the assemblies via couplers welded to the plates. Because of the facade location, columns had to be placed eccentrically on the grade beams. To avoid designing the entire 60' grade beam and its end connections against torsion, contractors placed transverse grade beams that spanned back to existing foundation piers next to the columns.

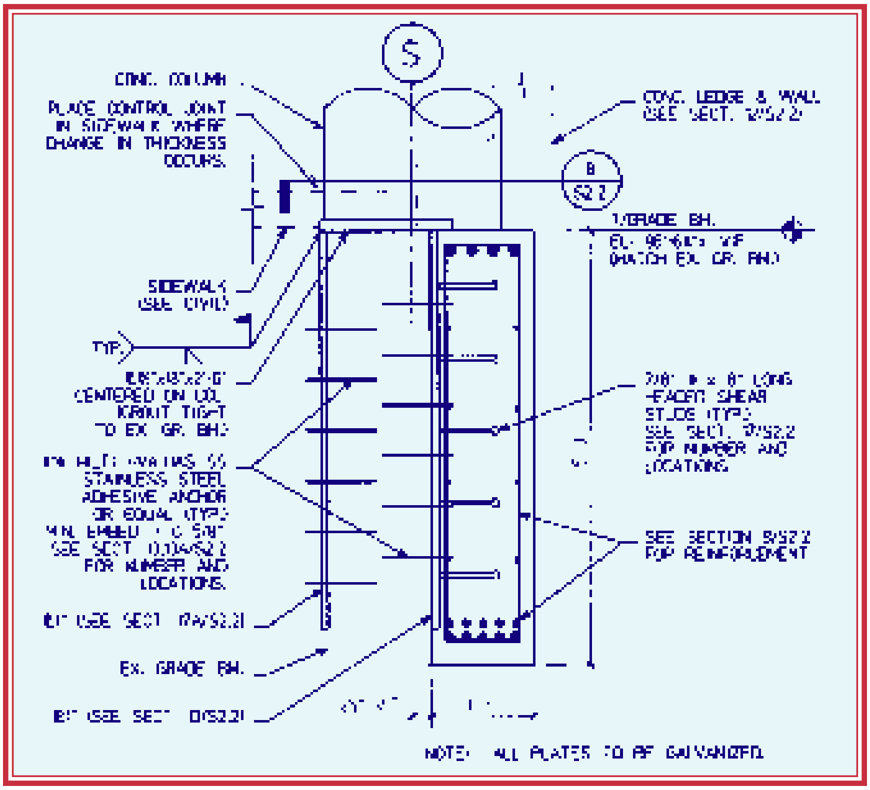
Another challenge was to maintain the depth of structural components and thickness of the resulting sandwich in both the roof and floor as small as possible. Each shop fabricated truss was limited to a height of 14'-6" to meet travel restrictions dictated by overpass and power line clearances. One truss piece was made eight feet longer to fit across an end support and extend the bridge into the new Pavilion. Added to that truss piece was a field splice positioned 3' from the center pier, making the longest shipped piece 78'.

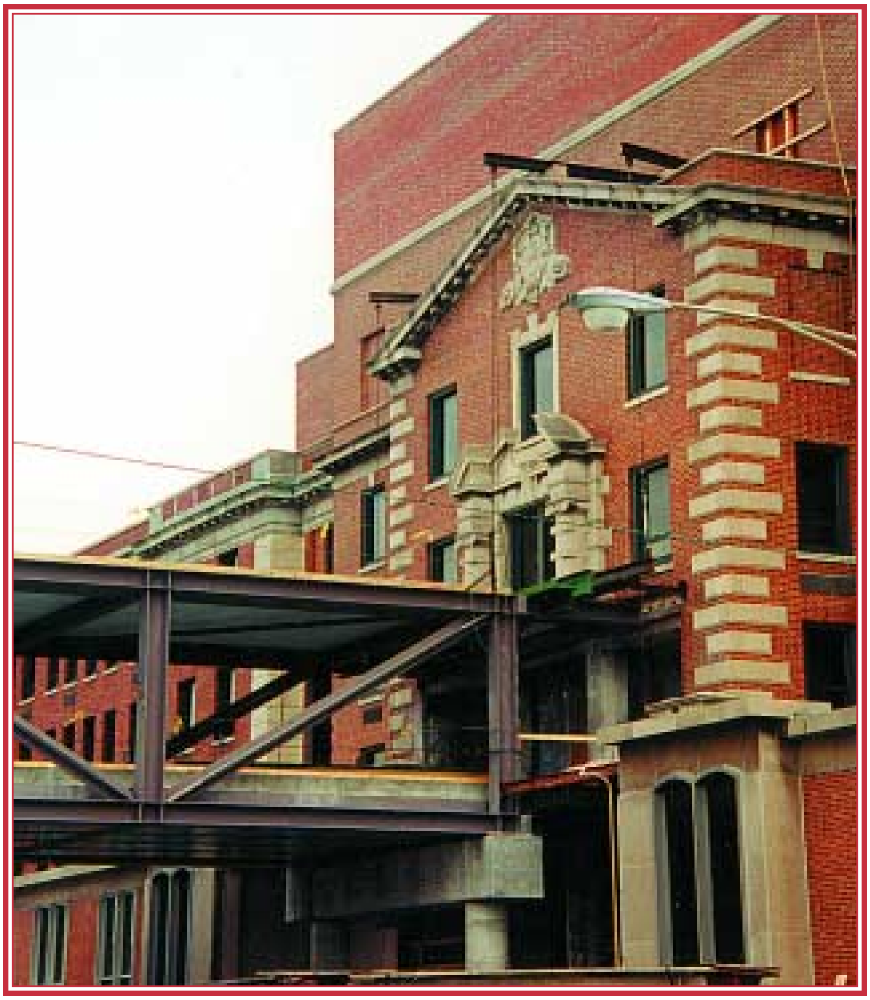
In addition to height restrictions, engineers had to accommodate an elevation difference. The third floor of the South Wing was 18" higher than the second floor of the Pavilion. Rather than sloping the bridge, a long shallow ramp was built within it. Using layers of rigid insulation as formwork, a 5" cast-in-place concrete one-way slab was made. Construction of the level floor areas matched the 2-hour fire rated construction used in portions of the Pavilion: a composite slab consisting of 3¼" lightweight concrete on 20 gage, 2" composite metal deck.

To support the ramp formwork and provide a finished appearance, a second layer of metal deck bearing on the bottom flanges of the floor beams was placed along the underside of the bridge. This narrow interstitial space and the insulation within were continued where no slope existed to provide a thermal barrier along the bottom of the exposed structure.

Using Staad III from Research Engineers, Inc., OWP&P Engineers created a three-dimensional computer model to analyze thermal movements and stresses as well as lateral and gravity loadings. To accommodate longitudinal movement, a 3" expansion joint was installed where the bridge meets the Pavilion. Slide bearing connections consisting of Teflon pads bonded to steel plates were provided at the truss bearing points in this location and at the bridge midspan. Because the floor slab was insulated while the bottom of its supporting members were not, detailing for differential movement was done to avoid inducing additional stresses. This was accomplished by separating the elements and supporting the slab on a series of double angles bolted together through long slotted holes.

Yet another challenge during the project involved preserving the existing facade as much as possible. At the point where the bridge penetrated the South Wing, brick, limestone and window elements had to be removed





including the bottom half of two stone columns. To temporarily support the upper portion of these columns, the construction manager, Pepper Construction in Chicago, hired a special consultant, Paul E. Mast Consulting Engineering in Chicago, to design a shoring system that tied needle beams to the existing wall. These, in turn, were supported by a cantilever beam hung over the roof of the bridge. The bridge structure was erected by All Erectors of Franklin Park, IL during a two-month period. California Avenue was closed for just under two weeks.

The decision to use steel as the structural material met budget constraints and aesthetic requirements. The appearance of exposed steel also mirrored the structural system used in the new building. All of the steel for this project was specified as ASTM A36. To minimize maintenance and maximize durability, Endura-Shield Polyurethane, a high-performance paint system by AISC-Associate Member Tnemec, was used. The gray paint color matched the aluminum finish of Galter Pavilion's window wall system.

The Swedish Covenant Hospital bridge has been well received by staff and the community. In fact, the hospital has used the bridge as an image builder, capitalizing on it as a metaphor for health care providers. While aesthetic requirements, budget constraints and future expansion drove its design, the bridge met two conflicting sets of conditions, one set by the City's Plan Commission and other by the client. The final design reflects creative solutions to those architectural, engineering and logistical challenges. This literally is a bridge upon which to expand the future facility needs of Swedish Covenant Hospital.

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