$25M OR GREATER, BUT LESS THAN $100M

NATIONAL WINNER

William J. Clinton Presidential Center Museum Building

Little Rock, AR

Photo courtesy Phelps Program Management.

Photo courtesy Polshek Partnership Architects.

JUROR COMMENT

"Innovative structural design that blends well with the surroundings."

The William J. Clinton Presidential Center, located in a park along the Arkansas River in Little Rock, AR features innovative connections and exposed structural steel in its Museum Building. Reminiscent of nearby train trestles, the building's five-story steel structure, measuring 420' long by 46' wide, is supported by a pair of 37'-deep trusses. The trusses cantilever 90' at each end of the building and are supported at three locations with a maximum clear span of 150' between supports.

The museum's main floor, which supports both the mezzanine level above and the mechanical level below, frames into the truss bottom chords. These bottom chords are built-up from steel plates to form boxes that measure 26" deep and 16" wide. Similar to the bottom chords, the truss top chords receive the roof framing, which in turn supports a private retreat for the Clinton Foundation located at the top of the building. Like the bottom chords, the top chords are built-up steel boxes, measuring 30" deep and 16" wide. The architecturally exposed box-shaped built-up diagonals of the building are kept at an outside dimension of 16" x 16" throughout. The decision to make the chords and the diagonals the same width was driven by architectural concerns and also allowed for relatively simple connection details that facilitated fast-paced construction.

At the north end of the building, the trusses are supported on a Vierendeel frame-type steel pier structure made up of box-shaped built-up members, forming a moment frame. The pier is capped by a 95-ton transfer girder that measures 12' deep, 3' wide, and 48' long. This transfer girder cantilevers in both directions to support the trusses. A special pin-support detail was developed atop the transfer girder to allow for rotation of the primary trusses without inducing secondary stresses into the pier.

To accommodate architectural and mechanical considerations, the pier structure is located off center with respect

Structural Engineer
Leslie E. Robertson Associates (LERA), RLLP, New York

Engineering Software
ETABS
RISA-3D

Owner
Clinton Presidential Foundation, Little Rock, AR

Architect
Polshek Partnership LLP, New York

Fabricator and Detailer
AFCO Steel, Inc., Little Rock, AR, AISC member, NISD member

Detailing Software
AutoCAD

Erector
Derr Steel Erection Co., Euless, TX, AISC member

General Contractor
CDI Contractors, LLC, Little Rock, AR

Photo courtesy Phelps Program Management.

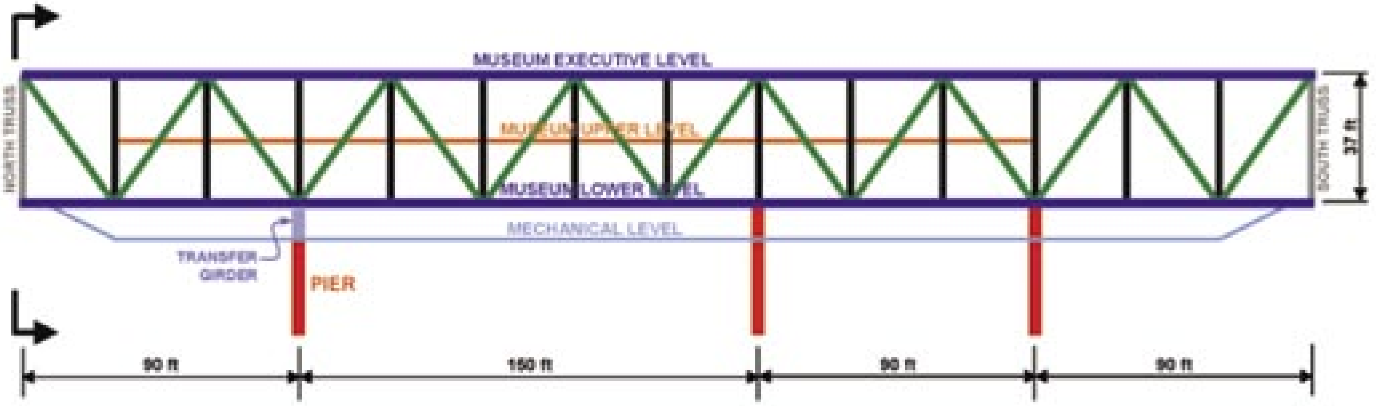
to the building's center of gravity. The resulting twisting forces are delivered to the building's shear walls by horizontal trusses located in the floor diaphragms at both the top and bottom chord levels. The horizontal trusses in the floor framing at the top and bottom chord levels act as collector and drag members that deliver lateral wind and seismic forces to the building's shear walls. They also act to provide stability during construction prior to the casting of the composite concrete floor diaphragms.

Vertical built-up box mullions, hung from the built-up box-shaped cantilever beams, carry both the balconies and the curtain wall. The lower level balcony is supported by beams cantilevering from the bottom chord of the truss. These beams provide lateral support at the bottom of the curtain wall mullions while allowing for vertical sliding, thereby allowing the balcony to move independently of the curtain wall.

For the western façade, double wall construction was used with the outer curtain wall cantilevering from the western face of the building. The resulting separation forms a space containing exterior balconies and museum areas that are shaded from the sun.

The goal for the entrance canopy was to provide a minimum structure where each part of the canopy is called upon to do work. Here, glass is configured to cantilever out from steel bars that pivot from a round bar. The columns supporting this bar are simple plate structures that cantilever up from foundations cast below the plaza paving. The result is a lightweight and transparent canopy.

Steel structure made possible this open and accessible building that reflects President Clinton's aspiration to "put things in the light." ★



TRUSS ELEVATION

Graphic courtesy Leslie E. Robertson Associates.

$25M OR GREATER, BUT LESS THAN $100M

MERIT AWARD

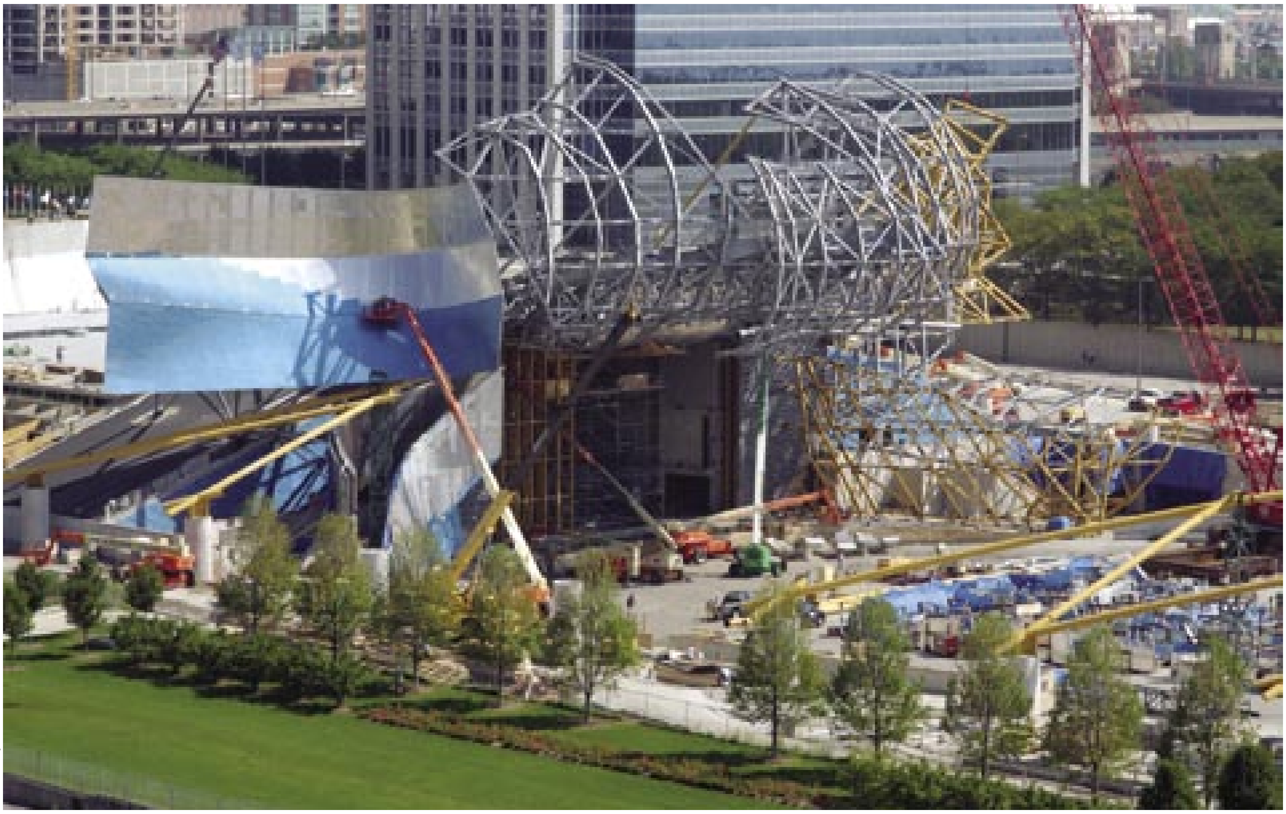


Photo by Peter Barreras.

Jay Pritzker Pavilion

Chicago

The Jay Pritzker Pavilion in Chicago's Millennium Park houses an orchestral stage area framed by enormous metallic forms designed and placed to improve the outdoor venue's acoustic characteristics.

The pavilion is composed of a south-facing bandshell housing the stage and related support facilities, which in turn support the metallic forms. The central portion of the bandshell roof cantilevers up to 100' beyond the proscenium door. There are a total of twelve individual metal-clad assemblies arranged around and above the central stage, forming an overall composition some 300' wide by up to 120' tall. Behind the upper metal surfaces, a system of inclined steel pipe struts connected to the bandshell structure stabilizes the metal elements.

A steel grid/ribbed frame concept was developed for the support of the metal elements, which proved to respond well to the diverse structural system requirements of the project. The structure was configured to closely follow the curvature of the shapes to take advantage of the inherent geometric stiffness of each form.

The basic structural system concept was developed and refined using computer-based surface modeling. First, a structural working surface was generated 2' behind the clad surface. Vertical slicing planes at 9'-8" centers and horizontal planes at 10' centers were electronically passed through the structural working surface. The intersections created the structural work points. Straight line segments connecting the work points formed an electronic wireframe representing the centerlines of the structural grid/frame members.

For this type of structure, with relatively few (450) steel tons, considerations other than least weight were far more important in terms of overall economy. To promote repetition and control of steel connection detailing and fabrication, as well as coordination with cladding systems and attachments, member sizes were standardized throughout the metal elements. Independent, parallel structural analysis

Structural Engineer
Skidmore, Owings & Merrill LLP, Chicago

Engineering Software
SOM AES software
S-FRAME
SAP2000

Architect
Gehry Partners LLP, Los Angeles

Detailers
Dowco Consultants, Ltd., Burnaby, British Columbia, Canada, AISC member, NISD member

Industrial Detailing, Inc. (trellis), St. Louis, AISC member

Detailing Software
Tekla Structures
SDS/2 (trellis)

Fabricators
Lejeune Steel Company, Minneapolis, AISC member

ACME Structural, Inc. (trellis), Springfield, MO, AISC member

Erector
Danny's Construction Company, Shakopee, MN, AISC member

Photo by Peter Barreras.

and design checks were done using two commercially available software programs, S-FRAME and SAP2000, for a complete loading regime including wind, temperature, snow, ice, and live load.

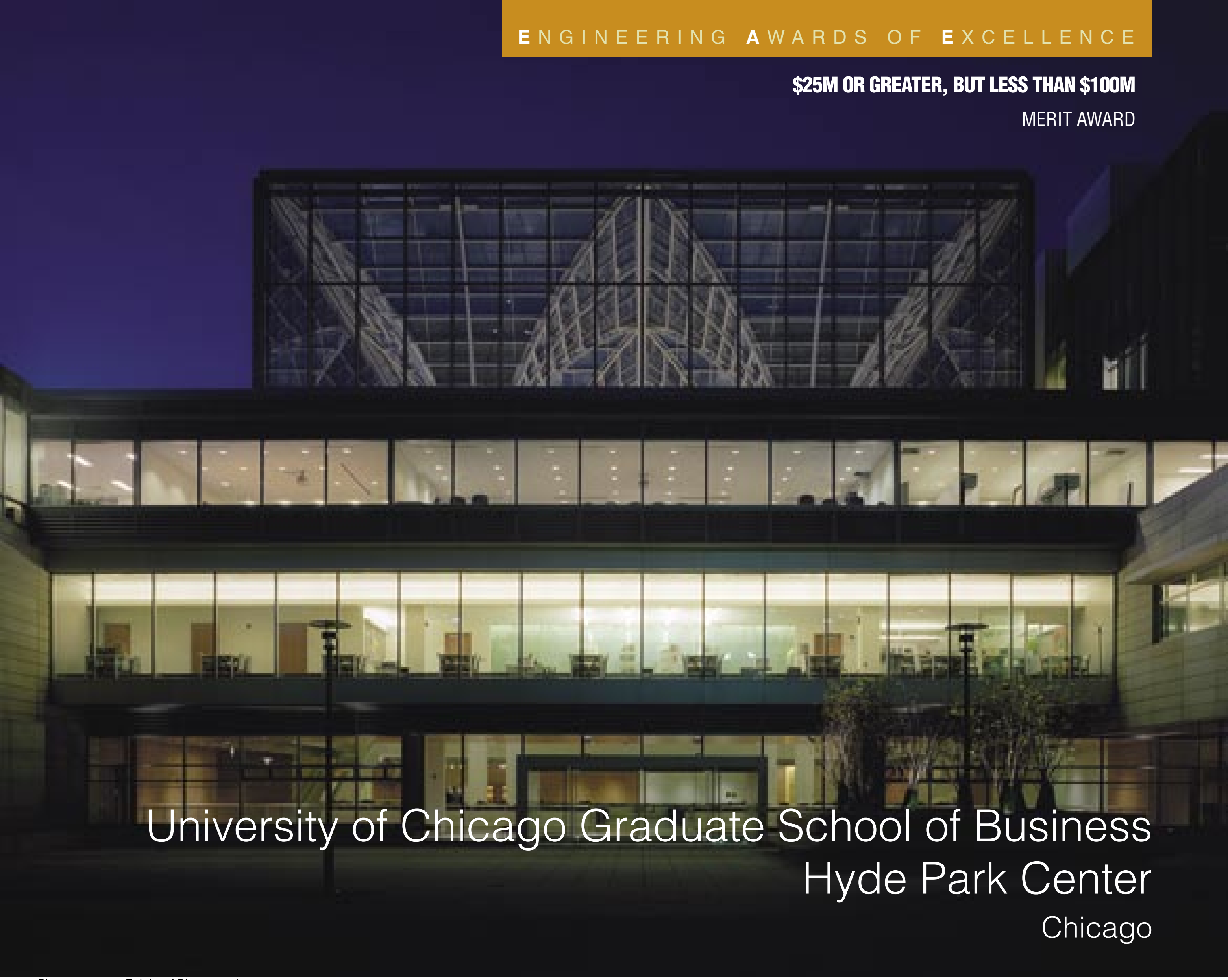
The drawings, together with the computer wireframe, were issued to the contractor as part of the project documentation. The steel detailers converted the wireframe electronic data into Xsteel for use in the preparation of shop drawings for the structural steel. The fabrication/erection concept was to prefabricate vertical sections of each metal element in the shop, trial fit and pre-assemble each section to neighboring sections in the shop, prepare the members for shop painting, and ship them to the site.

A 625' by 325' shell-shaped trellis structure, formed by arched steel pipes, defines the audience space and connects the stage to the great lawn. The trellis structure supports a system of speakers, eliminating the need for speaker towers.

Read more about Jay Pritzker Pavilion in "Music in the Park" in the August 2004 issue of *Modern Steel Construction*, available online at www.modernsteel.com. ★

$25M OR GREATER, BUT LESS THAN $100M

MERIT AWARD



University of Chicago Graduate School of Business Hyde Park Center

Chicago

Photo courtesy Feinkopf Photography.

Structural Engineer
Thornton-Tomasetti Group, Chicago

Structural Engineer Sub-Consultant
Dewhurst MacFarlane and Partners, New York

Engineering Software
RAM Structural System
SAFE
FloorVib 2
SAP2000

Owner
University of Chicago Graduate School of Business, Chicago

Architect
Rafael Viñoly Architects, PC, New York

Detailer
LTC, Inc., La Crosse, WI, AISC member

Detailing Software
DetailCAD
AutoCAD

Fabricator and Detailer
Zalk Josephs Fabricators LLC, Stoughton, WI, AISC member

Erector
AREA Erectors, Inc., Wheeling, IL, NEA member

General Contractor
Turner Construction Co., Chicago

The University of Chicago Graduate School of Business opened its new Hyde Park Center in September 2004. The 415,000 sq. ft academic facility is comprised of a base building with five above-grade levels and two below-grade levels, and a glass-enclosed Winter Garden. The complex features 12 classrooms, 31 group-study rooms, faculty offices, computer labs, multipurpose rooms and an underground parking garage for 170 cars.

In total, the base building used approximately 3,000 tons of structural steel, of which 500 tons were plate girders. The lateral system consists of braced framing located around the cores within the base building "square," as well as one braced frame in the southeast wing. The base building's lateral system is independent from that of the Winter Garden at the ground floor.

Photo courtesy Feinkopf Photography.

To isolate the systems, ground-level bridges that link the base building to the Winter Garden are on slide bearing connections.

The design called for massings to project over the building entrances below. The resulting cantilevers ranged from 3' to 42' and required over 600 moment connections. The cantilevers were often supported by transfer columns, while non-typical deflections were accommodated into the design and installation of the cladding. Spacer posts were used at the perimeter of projecting massings to limit differential deflections between floors.

More than 100 column transfers were required to achieve the column-free spaces in the center's multi-function room and the lower-level classrooms and parking levels. Plate girders varied in depth from 30" to 73", depending on architectural requirements, and weighed from 283 to 1,528 lb per linear foot. When service reaction loads for plate girders exceeded reasonable design limits for shear connections, a bearing connection was used to eliminate the effects of the eccentricity on the support column.

The Winter Garden is framed with structural steel and clad entirely with glass, soaring 83' at its apex. The garden's roof is supported by four main columns. Each column comprises eight 9"-diameter steel pipes with 1-5/8" walls clustered together to create a single column with an overall outside diameter of 33". The column bases are located at Lower Level 1, and diagonal bracing hidden in a demising wall of this level braces the columns at the ground floor. The columns rise nearly 43' above the ground floor as a vertical cantilever. They were fabricated in two sections, with the column splices hidden within the ground floor slab.

The eight pipes of each main column branch out to become roof rafters. The rafters curve to form intersecting Gothic arches, which create roof "funnels." As they rise nearly 40' above the tops of the columns, the rafters taper from an outside diameter of 9" to just 6". They support continuous purlins spaced approximately 6' on center. The purlins, rectangular tubes with outside dimensions of 6" by 3", support the roof glazing and provide bracing for the slender rafters. The four roof funnels, one centered on each of the four main columns, are interconnected to form the 96' by 96' roof.

The third floor of the base building cantilevers out 12' to support the glass walls that enclose the Winter Garden. Wall framing consists of 14" by 3" hollow mullions fabricated from 3/4" steel plate and 4.5" by 1" steel bar transoms. Mullions are spaced at 6' on center, while the transoms are aligned with the fourth, fifth, and sixth levels of the base building. The wall framing was fabricated as a series of "ladders," with two adjacent mullions and the transoms between them shop welded into a single assembly. As each "ladder" was erected in the field, the transoms between each assembly were installed using countersunk high-strength screws tapped directly into the mullions. At the fourth floor, sloping beams support a glass skylight and brace the Winter Garden wall back to the floor diaphragm of the base building.

Resistance to lateral loads is provided by three systems: the cantilevered main columns, out-of-plane bending of the perimeter wall mullions, and the in-plane rigid tube frame (mullions and transoms) of the perimeter walls.

Read more about the Hyde Park Center and Winter Garden in "Class Act" in the November 2004 issue of *Modern Steel Construction*, available online at www.modernsteel.com. ★

Photo courtesy Feinkopf Photography.