IDEAS²

Innovative Design in Engineering and Architecture with Structural Steel

THE DESIGN AND CONSTRUCTION INDUSTRY RECOGNIZES THE IMPORTANCE OF TEAMWORK, COORDINATION, AND COLLABORATION IN FOSTERING SUCCESSFUL CONSTRUCTION PROJECTS TODAY MORE THAN EVER BEFORE. In support of this trend, AISC has joined two previously separate architecture and structural engineering awards programs into one: The IDEAS² Awards. This awards program was designed to recognize all team members responsible for excellence and innovation in a project's use of structural steel.

Awards for each winning project were presented to the project team members involved in the design and construction of the structural framing system, including the architect, structural engineer of record, general contractor, detailer, fabricator, erector, and owner.

New buildings, as well as renovation, retrofit, or expansion projects, were eligible. The projects also had to display, at minimum, the following characteristics:

- A significant portion of the framing system must be wide-flange or hollow structural steel sections;
- Projects must have been completed between January 1, 2003 and November 1, 2005;
- Projects must be located in North America;
- Previous AISC IDEAS or EAE award-winning projects were not eligible.

A panel of design and construction industry professionals judged the entries in three categories according to their constructed values in U.S. dollars:

- Less than $15 million
- $15 million to $75 million
- Greater than $75 million

The judges considered each project's use of structural steel from both an architectural and structural engineering perspective, with an emphasis on:

- Creative solutions to the project's program requirements;
- Applications of innovative design approaches in areas such as connections, gravity systems, lateral load resisting systems, fire protection, and blast;
- The aesthetic and visual impact of the project, particularly in the coordination of structural steel elements with other materials;
- Innovative uses of architecturally exposed structural steel;
- Advances in the use of structural steel, either technically or in the architectural expression;
- The use of innovative design and construction methods such as 3-D building models, interoperability, early integration of specialty contractors such as steel fabricators, alternative methods of project delivery, or other productivity enhancers.

Both national and merit honors were awarded. The jury also selected two projects for the Presidential Award of Excellence in recognition of distinguished structural engineering.

2006 IDEAS² Awards Jury

Judsen R. Marquardt, FAIA, Founding Partner
LMN Architects, Seattle

Bobbi Marstellar, Vice President of Certification
American Institute of Steel Construction, Chicago

Robert E. Owen, Chairman and CEO
Paxton & Vierling Steel Company, Omaha, Neb.

Nadine M. Post, Editor at Large, Buildings, Design and Construction
Engineering News-Record, New York

Robert C. Sinn, Associate Partner
Skidmore, Owings & Merrill LLP, Chicago

Ronald D. Ziemian, Ph.D., Professor, Department of Civil and Environmental Engineering
Bucknell University, Lewisburg, Penn.

This year's jury, left to right: Ziemian, Marquardt, Marstellar, Post, Sinn, Owen.

National Winner—Less than $15M

STATION PLACE GARAGE—PORTLAND, ORE.

Richard Strode

JUROR COMMENT

"Transparency is the word here."

Station Place Garage is an integral part of a mixed-use development in downtown Portland, Ore. The 149,670 sq. ft parking structure provides space for 413 vehicles on five parking levels, and the design includes the potential for 1,000 sq. ft of commercial space at the ground level.

The 41,450 sq. ft, triangularly-shaped site created significant challenges. The City of Portland required that all parking be located on flat floor plates—not on ramps—so the building was designed with flat one-way parking levels and an interior two-way ramp.

During Portland's meticulous design review process, the review commission set out the following requirements:

1. Exposed structural steel diagonal bracing was not acceptable.
2. Glare from vehicle headlights had to be screened from view.
3. Vehicles parked on the top parking level had to be screened from the view of residents in nearby high-rise residential buildings.

Concrete shear walls were placed in the building's interior to address most of the structure's lateral loads. However, architects did not want to place a large concrete shear wall along the south façade, which is the most prominent of the building. Instead, exposed diagonal steel braces were designed for the lateral load, and the architect designed a full-height wall of folded stainless steel plates to hide the structural bracing from view.

Folded stainless steel guardrail panels with laser-cut holes were designed around the building perimeter to mitigate headlight glare. Four-inch diameter holes filled with colored discs were designed at headlight elevation. Lights from moving vehicles illuminate the colored discs at night, animating the building's exterior. Colors vary by parking level to assist user orientation.

When viewed from above, more than 40% of the building's footprint is "green." The atrium located on the third parking level is 1,812 sq. ft in area and is open to the sky. The top parking level has 2,411 sq. ft of planter space and 8,887 sq. ft of trellis, for a combined "green" area of 13,110 sq. ft.

All exposed structural steel is finished with shop-primed zinc-rich primer and field-painted with high-performance moisture-cured polyurethane to withstand Portland's mild climate and wet winters.

Once construction began, weekly meetings were held with the steel fabricator to identify and resolve potential issues, ensuring that the preparation of shop drawings and fabrication remained on schedule. The project included 1,069 tons of steel, and more than 1,300 shop drawings were prepared.

The total construction cost was approximately $9 million—around $21,910 per parking space.

Owner
Portland Development Commission, Portland, Ore.

Architect
Leeb Architects, LLC, Portland, Ore.

Structural Engineer
KPFF Consulting Engineers, Portland, Ore.

Engineering Software
RAM Structural System
SAP2000

Detailer
Pro Draft, Inc., Surrey, B.C., AISC member, NISD member

Detailing Software
Tekla Structures

Fabricator
Fought & Company, Inc., Tigard, Ore., AISC member

General Contractor
Andersen Construction Company, Inc., Portland, Ore.

Merit Award—Less than $15M

SKYBRIDGE—DAVENPORT, IOWA

Skybridge connects downtown Davenport, Iowa to city parks along the Mississippi River. It is a light, open structure with floor-to-roof glass exterior walls and light structural elements. Four pairs of 100'-tall masts support three bridge main spans of 160', 170', and 160'. The structure spans 570' over an existing four-level parking garage, four-lane highway, and railroad tracks.

The bridge is wider at the roof than at the floor, which allows the glass exterior walls to angle outward, reducing glare and solar heat gain. Eleven-inch by 6'-8" translucent glass panels are set into the precast floor slab of the walkway and provide a soft glow at night, illuminating the streetscape below. Access towers with overlooks are located at each end of the bridge.

To lighten the appearance of the structure, the engineering team selected a stayed structural roof system. Initial designs used cables for the stays, but ultimately the team chose rods, which were more cost-effective. The longitudinal and transverse roof beams, together with double angle diagonal bracing in the plane of the roof, form a horizontal truss, spanning between the masts to resist lateral loads. The bridge floor hangs from the roof structure with 1-¼" diameter rods spaced 10' apart along the length of the bridge.

Bridge support masts resist both gravity and lateral loads. The masts are built-up hollow box-shaped elements fabricated from steel plates and are internally stiffened with horizontal plates at the bridge floor and roof elevations. Access towers with overlooks are located at each end of the bridge. The towers have structural steel frames with diagonal bracing for lateral loads.

Read more about Skybridge in "Walking Tall" from the February 2006 issue of MSC, available at **www.modernsteel.com**.

Owner
City of Davenport, Iowa

Architect and Structural Engineer
Holabird & Root LLC, Chicago

Associate Architect
Neumann Monson, P.C., Iowa City, Iowa

Engineering Software
RAM Advanse

Steel Fabricator and Detailer
Zalk Josephs Fabricators, LLC, Stoughton, Wisc., AISC member

Steel Erector
Azco Integrated Construction, Inc., Appleton, Wisc., NEA member

General Contractor
Russell Construction Company, Davenport, Iowa

Dale Photographics, Inc.

JUROR COMMENT

"The inherent qualities of compression and tension in steel are gracefully expressed."

Merit Award—Less than $15M

GOVERNMENT CANYON STATE NATURAL AREA—SAN ANTONIO

Steel-framed structure is an integral part of the Government Canyon State Natural Area visitor center's architecture. The building lies in the recharge zone of the Edwards Aquifer, which supplies water to nearby San Antonio. Recycled steel HSS provided a sustainable solution for the facility, as well as a flexible structural solution used to achieve interesting shapes in the center's clear spans and roof.

The building program includes classrooms, offices, an exhibit hall, outdoor exhibit pavilion, amphitheater, interpretive trails, and two ranger residences. The design of the center breaks the building down into wings: an administration wing to the east and an educational center in the western wing.

Throughout the project, salvaged and recycled materials display the conservation ethic behind the center's establishment. Recycled HSS were used to create structurally interesting features throughout the center's clear-span spaces.

An exhibit space opens up to a courtyard. Along with this space, classrooms form the heart of the educational center. The classrooms open up to the savanna and provide canyon views through a broad porch.

Adjacent to the classrooms and exhibit space, a gravity feed water tower forms the edge of the outdoor classroom. Water is collected from three separate steel-framed roofs and is stored in interconnected underground cisterns.

Lake|Flato Architects

Owner
Texas Parks and Wildlife Department, Austin

Architect
Lake|Flato Architects, San Antonio

Structural Engineer
Architectural Engineers Collaborative, Austin

Engineering Software
RISA 3D

Fabricator
Ironhorse Iron Works, Inc., Lorena, Texas, AISC member

Erector
Moore Erection Company, Inc., Garden Ridge, Texas, AISC member, SEAA member

General Contractor
Tom Page & Company, Inc., San Antonio

National Winner—$15M or greater, but less than $75M

WILLIAMS COLLEGE '62 CENTER FOR THEATRE AND DANCE—WILLIAMSTOWN, MASS.

The '62 Center for Theatre and Dance at Williams College emphasizes the importance of a connection between theater and dance with other disciplines on a liberal arts campus. The center provides a direct path that connects to nearby dormitories, enabling students who are not involved in the theater or dance programs to be exposed to these two departments.

Structural steel was the ideal choice for framing the project's complex geometry and variety of uses while conforming to the overall and detailed aesthetic goals.

The center features four main venues for the performing arts: a 550-seat main stage theater; a 200-seat center stage theater that features movable balconies, a flexible lift, and a 20'-high steel sliding door that opens directly onto the lobby; a dance studio; and an existing theater that was converted to an intimate 210-seat "thrust" theater.

Paired HSS columns with intermediate HSS horizontals at the building's entry and dance studio, coated with intumescent paint, create transparent glass enclosures while forming a rigid moment frame to support gravity and lateral loads.

Lightweight steel "gondolas" hang from the center stage theater's roof on monorail tracks, allowing repositioning as dictated by the performance requirements.

Owner
Williams College, Williamstown, Mass.

Architect
William Rawn Associates, Architects, Inc., Boston

Structural Engineer
LeMessurier Consultants, Cambridge, Mass.

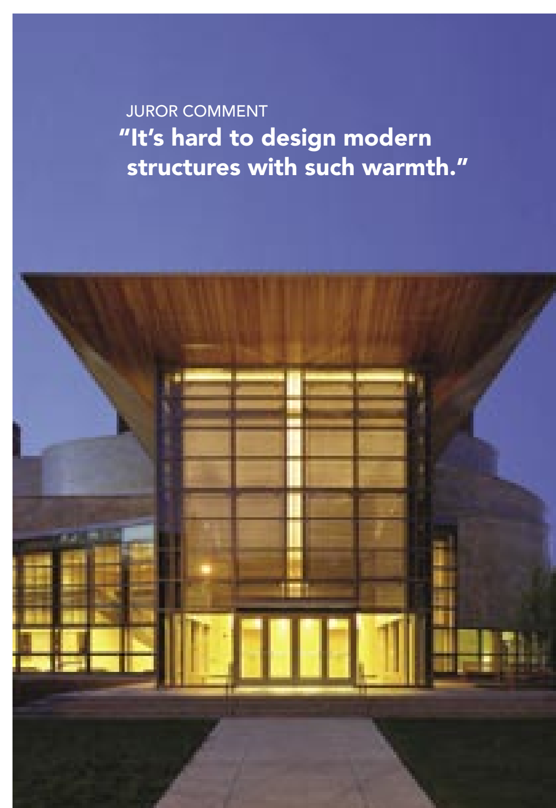
Engineering Software
STAAD Pro

Detailer
Base Line Drafting Services, Inc., Concord, Ontario, NISD member

Detailing Software
SDS/2
SteelCAD
AutoCAD

Steel Fabricator and Erector
Cives Steel Company, Augusta, Maine, AISC member

General Contractor
Barr and Barr, Inc. Framingham, Mass.



Robert Benson Photography

Merit Award—$15M or greater, but less than $75M

HUNTER MUSEUM OF AMERICAN ART—CHATTANOOGA, TENN.

Tim Griffith Photography

JUROR COMMENT

"A creative juxtaposition of structural materials produced a geographically sensitive museum."

A 2005 renovation and expansion of the Hunter Museum of American Art in Chattanooga, Tenn. transferred the museum's image from that of a private space—a 1905 mansion—to a civic forum for the arts.

The project re-establishes the primacy of the mansion, which was first expanded in the 1970s, as the center of the museum complex and brings balance to the overall facility and site composition.

The expansion rises above a limestone bluff overlooking the Tennessee River, and a new steel-framed pedestrian bridge forms a link from the site to the city's downtown.

Structural steel was selected to support the expansion's long spans—including floor spans of 52' and cantilevered spans of 25'— and high load conditions. The design improves museum functionality for visitors by consolidating the permanent collection onto a single floor. The collection is accessible through new public areas including a lobby, auditorium, education studios, café, and gift shop.

A new temporary exhibitions gallery is located above the auditorium. This design frees the lower level for administrative and museum support areas. A new below-grade loading dock minimizes delivery traffic presence on the site and supports a new suite of spaces for receiving, exhibit preparation, security, and art storage.

The exterior consists of a glass and aluminum curtain wall, oxidized zinc cladding, and a stainless steel roof. Structural steel was used to achieve the multi-directional curves of the roof, minimizing its weight and allowing its vertical elements to remain slender.

Owner
Hunter Museum of American Art

Architects
Design—Randall Stout Architects, Inc., Los Angeles
Associate—Derthick, Henley & Wilkerson Architects, Chattanooga, Tenn.

Structural Engineer
John A. Martin and Associates, Los Angeles

Engineering Software
RAM Structural System
RISA 3D
SAP2000

Fabricator, Erector, and Detailer
Superior Steel, Inc., Knoxville, Tenn., AISC member, NISD member

Detailing Software
SDS/2

General Contractor
EMJ Corporation, Chattanooga, Tenn.

Merit Award—$15M or greater, but less than $75M

SEATTLE CITY HALL—SEATTLE

Nic Lehoux

JUROR COMMENT

"Light and transparent, Seattle City Hall takes advantage of steel as both structure and ornament."

This steel and glass structure is comprised of a lobby, council chambers, and executive offices. In the lobby, closely spaced slender steel columns taper toward a trellis of steel beams that extends outward to form a light canopy over the sidewalk and plaza. The same steel components create a trellis and lantern in the plaza, terminating a red glass wall at the northwest entrance of the building.

Deep horizontal steel and aluminum shelves shade the west face of the seven-story executive office block. The curving south face echoes the form of the council chamber below. The steel structure cantilevers to support the elevator lobby and primary public corridor that stretches across this face, leaving the thinnest possible floor against the window wall to maximize views.

By means of its expressed steel structure, the curtain wall on all faces of the tower cantilevers beyond the building's enclosure to break down the building's bulk and reinforce its sense of lightness and transparency. This is reasserted at the building's top by the steel and glass canopy that wraps around the mayor's terrace.

Daylight control and an air distribution system beneath the floors reduce fuel consumption and enhance the work environment. A planted roof reduces runoff by soaking up Seattle's abundant rainwater, allowing it to evaporate gradually. Excess water is harvested in an underground cistern and used for irrigation and water closets.

The building received a Gold LEED rating from the U.S. Green Building Council.

Owner
The City of Seattle

Architects
Bassetti Architects/Bohlin Cywinski Jackson joint venture, Seattle

Structural Engineer
KPFF Consulting Engineers, Seattle

Engineering Software
RAM Structural System
ETABS
IES Visual Analysis
SAP2000

Miscellaneous Steel Fabricator
George Third & Son Industries, Lynwood, Wa., AISC member

General Contractor
Hoffman Construction Company, Seattle

National Winner—$75M and greater

LESTER B. PEARSON INTERNATIONAL AIRPORT—TORONTO

Timothy Hursley

JUROR COMMENT

"A very interesting mix of structural shapes and systems that accommodates the program elements."

Long-span steel framing created large, open spaces within Toronto's Lester B. Pearson International Airport, which will accommodate an estimated 29 million travelers yearly by 2015. The 3.6 million sq. ft airport terminal's steel frame provides minimum column obstructions that enable ease of passenger circulation and uninterrupted views.

The terminal's departures hall features architecturally exposed structural steel (AESS) long-span arch members with linear skylights. The passenger concourse and circulation mezzanines are contained within double-height spaces, and their functional zones are defined by the structural grid. Lateral and seismic bracing are fully exposed and integrated into the functional planning of the spaces.

The baggage claim and arrival halls, similar to the departures hall, are defined by the use of skylights in combination with the long-span roof's buttress structures.

Steel was exposed in areas with large load spanning conditions to identify the essence of the structural design. The main support members are exposed, and load transfers and connections are defined as visible design elements—such as wishbones—that express the nature of the supporting and bracing elements.

AESS steel on the departures level is in tension with the roof arches, acting as bow. The path to the departure gates is bridged by glass floors and wishbone-shaped brackets that transfer forces from the southern vaulted arches into concrete buttresses that anchor the hall's roof panels. Forces from the northern arches are transferred to double columns with horizontal and diagonal braces that tie the roof forces into the third level floor structure.

Great attention was given to connecting the AESS details with the other structural elements and materials, such as extruded aluminum in the curtain wall backup system; concrete buttresses; stainless steel pins, caps, and tension cables; and steel castings.

All AESS members were fabricated from steel plate with square edges. Diagonal, lateral, and horizontal forces are expressed as pin-connected braces.

Owner
Greater Toronto Airport Authority, Mississauga, Ontario

Architects
Airport Architects Canada (AAC) joint venture:
Skidmore, Owings & Merrill LLP, New York
Adamson Associates Architects, Mississauga, Ontario
Moshe Safdie and Assoc., Somerville, Mass.

Structural Engineers
Arup, New York—schematics and design development
Halcrow Yolles, Toronto—Engineer of Record

Engineering Software
SAP2000, RAM Structural System

Erectors
ADF International, Inc., Terrebonne, Quebec, AISC member
Blenkhorn-Sayers Structural Steel Corp., Mississauga, Ontario, AISC member

General Contractor
PCL/Aecon joint venture, Mississauga, Ontario

Merit Award—$75M and greater

SAN JOSE CIVIC CENTER—SAN JOSE, CALIF.

Englekirk & Sabol Consulting Structural Engineers

JUROR COMMENT

"The dome's structural solution is its architecture."

San Jose's new civic center consolidates the executive and legislative branches of its municipal government. The center includes an 18-story tower, a 104'-tall rotunda, a low-rise council wing, a 300-car subterranean parking structure, and a public plaza. Structural steel was selected as the primary structural system for the above-grade portions of the project because it reduced overall building weight—an important consideration on a site plagued with a high water table. It also reduced overall building height—significant because the site is in the flight path of an airport. Steel also easily permitted the long spans and cantilevers integral to the project's architectural design.

Although domes are traditionally associated with masonry or concrete construction, steel was the most cost-effective, constructible, and elegant structural system for the rotunda. A 59'-tall drum supports the 95'-diameter dome. Cantilevered elements increase the actual diameter of the drum to more than 110', while a brise soleil stands off the exterior of the dome and increases its apparent size.

Twelve tapered built-up box sections, in the form of inverted Js, form the primary structural columns for the drum and ribs of the dome. The ribs meet at a glazed oculus that serves as the compression ring. Horizontal thrust is resisted by the ribs in flexure—a continuous tension ring could not be accommodated by the architectural design. Concrete fill in the ribs provides additional structural stiffness.

The design of the tower used structural steel to provide clear span spaces that maximized the flexibility of the office spaces, increased available ceiling height, and limited overall project height. Structural steel also simplified the planning of the tower because it permitted the tall, long-span space needed for the consolidated municipal service stations.

The tower uses architectural concrete shear walls to provide seismic resistance in the east-west direction, but the building's height required a dual system employing steel special moment frames to satisfy building code requirements. Steel special moment frames provide lateral resistance in the north-south direction. The narrow east-west dimensions precluded the use of shear walls. A steel eccentrically braced frame, using wide flexural links, maximizes glazing in the elevator tower while allowing unimpeded access to the elevators.

Structural steel is used as a fundamental architectural design element in the brise soleil, exterior stairs and rails, and the rotunda. It increased the transparency of the rotunda's dome, flooding the interior with light. Concrete fill in the ribs provides a thermal mass sufficient to eliminate the need for other fire protection.

The tower is oriented to maximize the benefits of natural ventilation from the prevailing breeze, but this exposes significant glazing to the western sun. The brise soleil serves as a 12-story cantilevered sunshade that provides needed protection from the sun while admitting filtered sunlight into the office floors. It also animates the western elevation by recalling the sweeping curve of the battered wall. Exposed structural steel provides the strength needed for the brise soleil's cantilever, thereby strengthening it as a key design element. The slender sections help maximize the screen's transparency.

Owner
City of San Jose, Calif.

Architects
Richard Meier & Partners, Los Angeles
Steinberg Architects, San Jose, Calif.

Structural Engineer
Englekirk & Sabol Consulting Structural Engineers, Inc., Los Angeles

Engineering Software
RAM Structural System, RAM Perform 2D, ETABS

Detailer
Candraft Detailing, Inc., Port Coquitlam, British Columbia, NISD member

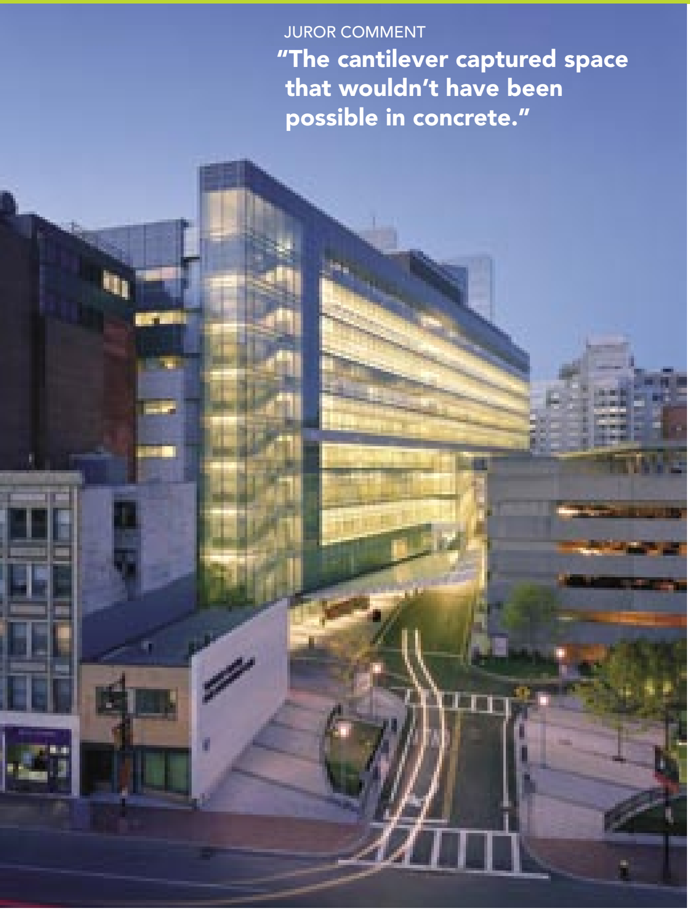
Detailing Software
AutoCAD, Xsteel

Fabricator & Erector
Strocal, Inc., Stockton, Calif., AISC Member

General Contractor
Turner/Devcon joint venture, San Jose, Calif.

JUROR COMMENT

"The cantilever captured space that wouldn't have been possible in concrete."



Bruce T. Martin

Merit Award—$75M and Greater

YAWKEY CENTER FOR OUTPATIENT CARE—BOSTON

The Yawkey Center for Outpatient Care at Massachusetts General Hospital (MGH) unites innovative design and state-of-the-art construction methodology to significantly improve the efficiency of hospital services and enhance the overall patient experience. The facility was designed to address a number of key issues for MGH, including the addition of much-needed parking, the routing of patient and staff pedestrian traffic from a new public transportation station, and, most importantly, the consolidation and relocation of ambulatory clinics that had been scattered across the MGH campus.

Not only was the building designed to accommodate over a half million patient visits annually, but also to provide a new entrance to the institution, as future projects will make the Yawkey Center the west side of the hospital's planned entrance corridor.

The 420,000 sq ft. project features a six-story, 725-car underground garage, the disassembly and reconstruction of a portion of the historic Charles Street Jail, and a new ten-story facility that serves as home to a broad range of clinics for radiology, cancer treatment, pediatrics, women's health, reproductive medicine, cardiology, and musculoskeletal disciplines.

The center is tightly sited between the Charles Street Jail and an existing garage on the hospital's campus. Each challenge presented by this confined site had to be met within zoning height limitations and under an accelerated construction schedule.

The primary structural system is comprised of composite joist framing on a 30' × 36' grid. The grid is skewed 12 degrees from horizontal, which allowed the MEP services to exist within the same space as the structure. It also provided an extra floor of occupied space while meeting the site's zoning requirements.

This system was supplemented in several areas:

- Vierendeel trusses and long-span built-up plate girders were chosen to support columns at transfers to allow for clear drive lanes into the center's 725-car underground parking structure.
- A 120'-long, two-story steel transfer truss with a 30' cantilever supports the upper five levels of a corner of the building that extends above a parking garage on the adjacent site.
- Composite steel wide-flange framing was used at localized areas and was used to support an eighth-floor roof garden and a two-level conference area hung from the roof framing.
- Various features of the building were constructed using AESS wide-flange and tube shapes, including the reconstruction of a historic limestone façade at an atrium that will connect to a future wing.

In order to meet the schedule requirements of the project, the owner, contractor, and design team elected to use the "up-down" construction technique, which allowed for steel erection to begin with the start of excavation for the six-story underground parking structure.

Six-story-long continuous steel columns embedded in caissons were installed to support a composite steel transfer level at the plaza elevation. Once the plaza framing was completed, erection of the steel superstructure and the excavation of the garage continued simultaneously. Steel column sizes in the garage were coordinated with the construction schedule to accommodate the unbraced lengths present at various stages of superstructure erection, as well as the corresponding garage floor framing infill that followed excavation.

Owner
Partners HealthCare System, Inc., Boston

Design Architects
Cambridge Seven Associates, Inc., Cambridge, Mass.
Michael Fieldman, Architect, New York

Structural Engineer
McNamara/Salvia, Inc., Boston

Engineering Software
RAM Structural System

General Contractor
Walsh Brothers, Inc., Boston

Presidential Award of Excellence—Engineering—Less than $15M

PENNSYLVANIA HOSPITAL WIDENER BUILDING EXPANSION—PHILADELPHIA

Pennsylvania Hospital was overcrowded and needed to expand, but the hospital campus, located in downtown Philadelphia, had no available land for new construction.

A steel-framed vertical expansion was designed and constructed to bridge over an occupied and functioning emergency care center without disrupting the center's activities. The new structure bears on a line of tall columns located at each end of the existing building.

The primary support of the gravity framing consists of 18'-deep steel trusses constructed using W12 sections with bolted gusset plate connections. The trusses span 80' and are designed to carry the weight of the fourth through ninth floors. The columns supporting the north end of the trusses were lowered three stories through holes cut into the existing building and were braced by the existing floor framing at each level. Intumescent fire protection was applied to the columns before they were lowered so that the emergency care center's functions would not be disturbed. Two lines of columns were constructed at the south end of the trusses on either side of an existing loading dock ramp.

Third floor beams frame to new posts that bear on existing building columns only 4" below the bottom of the new third floor framing. The tight space between the new framing and the roof deck made it impossible to use conventional spray-applied fire protection after the new metal deck and slab were installed. Short strips of metal floor deck were welded to the top of the steel beams to provide fire protection in a manner consistent with a UL rating. Fire protection was spray-applied to the steel beams, as well as to the cavities between the beam flanges and underside of the metal deck. Full-length strips of metal floor deck were placed over the short deck strips and welded to the framing.

The new fourth floor framing was designed to be constructed in two stages to avoid interference with an existing mechanical penthouse. The penthouse, located in the center of the roof, had to remain in operation until mechanical units were installed and running on the new fifth floor.

The fourth floor beams are framed to hangers on the bottom chord of trusses that are 12' above. The bottom chords of the trusses serve as the main framing members for the fifth floor. The hangers that support the fourth floor are connected into the panel points at the bottom chord of the trusses.

The roof framing is horizontally braced to provide sufficient bracing for the truss top chords. Wide-flange stub columns are welded to the top chord of the trusses to simplify a future four-story vertical expansion.

The steel trusses are designed to limit the deflection that will occur during the planned vertical expansion. Stiffer steel trusses are located adjacent to brick façades, and larger-than-normal brick control joints are used to minimize the effect of deflection and movement of the brick faced panels. Slip tracks are located at the top of interior partitions.

The existing building structure was connected to the new structure's lateral load system so the new gravity load could be added to the existing columns without reinforcement. This allowed all of the existing columns to be analyzed as gravity-only columns.

The resistance to wind and seismic loads is provided by two braced frames in each direction. Three of the braced frames are located over a loading dock ramp using fully welded bents at the bottom level to allow for the passage of trucks. The fourth braced frame is located between two new columns that are installed within the existing building.

Ballinger

JUROR COMMENT

"It created space that couldn't ever have been created without steel."

Owner
Pennsylvania Hospital, Philadelphia

Architect and Structural Engineer
Ballinger, Philadelphia

Engineering Software
RAM Structural System, STAAD Pro

Fabricator, Erector, and Detailer
Samuel Grossi & Sons, Inc., Bensalem, Penn., AISC member

Detailing Software
SDS/2

General Contractor
Barclay-White/SKANSKA, Blue Bell, Penn.

Presidential Award of Excellence—Engineering—$15M or greater, but less than $75M

SAN BERNARDINO VALLEY COLLEGE MASTER PLAN AND NEW BUILDINGS—SAN BERNARDINO, CALIF.

Campus administration at San Bernardino Valley College learned in 1999 that a major earthquake fault and fold zone slices diagonally through their campus—seriously compromising the structural integrity of many of the buildings and the safety of the students and faculty.

A master plan and design for five new buildings that employ a new brace frame system was developed to replace the structures located within the fault zone and to establish a new architectural campus character.

Due to the proximity of the fault line, the seismic lateral forces were calculated to be four times that of other California locations. Structural engineers selected an Unbonded Brace Frame (UBF) system that was developed in Japan. The UBF system is similar to a conventional chevron brace frame system, with the exception that the braces do not buckle in compression. An unbonded brace is a steel plate or cruciform section that is sized based on its axial stiffness and its tensile yield strength. To ensure equal strength in tension and compression, a concrete-filled steel shell is placed around the brace to prevent buckling in compression.

The steel core is unbonded from the surrounding concrete to ensure that it is the only portion carrying the axial load. The brace is bolted to gusset plates at each end. In a major seismic event, the unbonded brace is expected to yield while the rest of the lateral system remains elastic. In the worst-case scenario, the yielded or damaged braces may simply be unbolted and replaced.

Within each of the five new structures, an average of 82 unbonded braces, many exposed, were used to resist the lateral forces.

Rather than ignoring the existence of the fault, the new master plan uses the fault zone as a means of orienting the new components of the campus and influencing their physical design. The fault zone itself, a "no build zone," is made visible with the introduction of a tree-lined roadway and indigenous gardens running diagonally through the site. The five new buildings are oriented parallel and perpendicular to this line, relating to the fault zone rather than the existing campus grid.

JUROR COMMENT
"An early adaptation of Japanese technology."

Campus Master Plan

Plan and photographs: Steven Ehrlich Architects

Owner
San Bernardino Community College District, San Bernardino, Calif.

Architects
Design—Steven Ehrlich Architects, Culver City, Calif.
Executive—Thomas Blurock & Associates, Costa Mesa, Calif.

Structural Engineer
Arup & Partners, Los Angeles

Engineering Software
SAP 2000

Detailer
SNC Engineering, Inc., Compton, Calif., AISC member, NISD member

Detailing Software
AutoCAD, Xsteel

Fabricator
W&W Steel Company, Laguna Hills, Calif., AISC member

Erector
Eagle Iron Erectors, Inc., Fontana, Calif., AISC member

General Contractor
Bernard Bros., San Fernando, Calif.