Innovative Design in Engineering and Architecture with Structural Steel

IDEAS² awards

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 is proud to present the results of its annual IDEAS² Awards competition. This program is 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 a 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, 2005 and December 31, 2007;
- ➜ Projects must be located in North America;
- ➜ Previous AISC IDEAS² 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 3D 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.

2008 IDEAS² Awards Jury

Craig McNay, chairman and CEO, CMC Holding Corp., Chicago

Lucien Lagrange, Lucien Lagrange Architects, Chicago

Charlie Thornton, founding principal, Thornton Tomasetti, and chairman, Charles H. Thornton and Co., LLC, Easton, Md.

Jerrold Pault, vice president and district manager of the Capitol District, Hensel Phelps Construction Co., Washington, D.C.

Steve Porter, AISC Treasurer and president of Indiana Steel Fabricating, Indianapolis

Katie Gerfen, associate editor, *Architect* magazine

Geoff Weisenberger, associate editor, *Modern Steel Construction* magazine

Heifer International Headquarters, Little Rock (a National Winner in 2007).

Nic Lehoux

National Winner—Under $15M

156 WEST SUPERIOR CONDOMINIUMS—CHICAGO

This nine-story mid-rise tower explores the steel and glass language of the "second Chicago school" of architecture, which was defined by the work of Mies van der Rohe and early SOM designs. Expressed through simple and elegant detailing within a minimalist aesthetic, the building is meant to invest an image of structural architecture, conveying a sense of economy, efficiency, discipline, and order.

Located in the River North neighborhood of central Chicago, the project occupies a tight 45-ft by 100-ft mid-block site bounded by alleys on the west and north and an historic stone townhouse on the east. A lobby and tenant parking occupy the ground floor, with eight levels of housing above. The structural frame becomes a visible system that lends scale and identity to the building.

To articulate the building mass, a steel-framed structural bay, fully enclosed in glass, occupies the center portion of the south and north elevations. By expressing these elevations as a series of two-story frames with steel X-braces, the building seems taller than its 120-ft height and is able to hold its own in a dense area of tall buildings. The steel frames support cantilevered decks, enclosed with stainless steel railings, for each unit, as well as louvers for privacy from adjacent development. The building's base of concrete masonry provides a solid podium that visually supports the light steel-and-glass tower. The narrow building frontage led the team to develop units that span the entire width of the structure, creating a visual identity for each homeowner within the floor-to-ceiling glass façade.

For more on this project, see "Squeezed" in our June 2007 issue at **www.modernsteel.com/archives**.

Architect
The Miller Hull Partnership, Seattle

Associate Architect
Studio Dwell Architects, Chicago

Owner/Developer
Ranquist Development, Inc., Chicago

Structural Engineer
Thornton Tomasetti Engineers, Chicago

General Contractor
Skender Construction Company, Palos Hills, Ill.

Nic Lehoux

Merit Award—Under $15M

CHRISTY WEBBER LANDSCAPES GREENWORKS PROJECT—CHICAGO

For over a century, a 12-acre land parcel just west of downtown Chicago was used for industrial purposes, serving as the home to one railroad company, then another, then a rock-crushing operation, and finally a city impound lot.

Fast-forward to the 21st century, when the principals of Christy Webber Landscapes (CWL) proposed a new vision for the site; the organization recently assembled a professional team and formed a company called Chicago GreenWorks to develop the area into an eco-industrial office park.

From conception to completion, the focus was on a thoroughly integrated design approach to make the most of free, renewable, and recycled resources to achieve a highly energy-efficient building. The CWL complex is actually three separate buildings that are sited to form an open-ended courtyard, with direct views of Chicago's downtown skyline. The largest of the buildings, the warehouse building, is located on the north side and provides access to and from the CWL storage yard. The southern-most building, a long narrow rectangle, is the main office wing and is the public entry point. The center building, a two-story structure, links the office and warehouse buildings and provides access to the greenhouse and the intensive green roof above the office building.

Supporting Sustainability

The use of structural steel was integrated throughout the project into its energy-generation and energy-saving features, as well as into the overall architecture. Structural steel's high recycled content, as well as its suitability to carry the heavy green roof loads, made it a natural choice for this LEED Platinum structure. All of the exposed structural steel was fabricated with standard AISC tolerances and finishes to reduce the additional energy use associated with AESS fabrication.

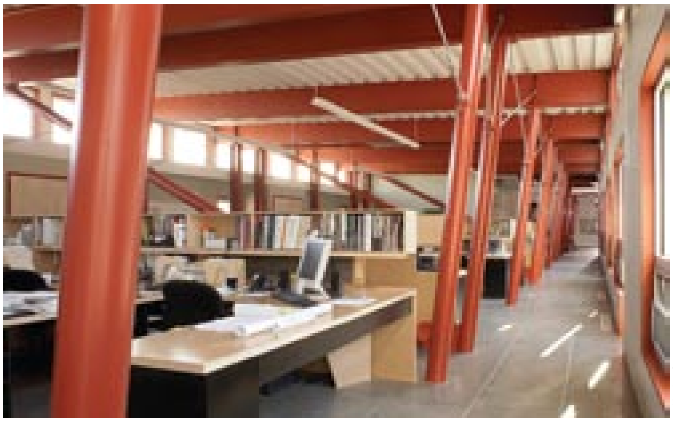
Flexibility in controlling solar heat gain has been optimized by careful and thoughtful integration of the structural elements with the architectural and mechanical elements. Slender round HSS columns are located on the interior to allow column-free exterior window walls to maximize natural light and minimize energy use. In addition, the east-west steel framing in the main office building is embedded within the composite roof slab and allows a higher ceiling height, resulting in unobstructed natural light. The sloped roof and sloped columns are braced not with costly moment frames or moment connected bases, but with bracing that divides the work stations without the use of partitions. In the end, the simple structural steel system also provided an overall lighter structure on smaller footings than the comparable concrete system that was originally considered for the project.

Structural steel is the backbone of some of the facility's "feature" elements as well. A wind turbine tower, located adjacent to the bioswale water detention pond, is constructed of round 2- and 3-in.-diameter HSS shapes that were shop fabricated into five sections. The round standard steel sections were fabricated and shop welded to the plate rings, and the horizontal ring elements are field bolted. The entire tower was erected in one day.

Steel also supports the solar capacity of the project. When visitors enter the office building through the front door, they pass under an eight-panel active solar thermal system supported on a sloped exposed structural steel frame. Exposed steel also enhances the second-story greenhouse, which provides growing space as well as pre-heats cold winter air, reducing the need for heat production by the building's other systems.

Steel is also present in the extensive green roof that covers a large portion of the main office building, where it supports the heavy soil loads. Additionally, the east-west light steel rod bracing maximizes the glazing while exposing the skeletal structure.

Shortall



Shortall

DZSE

Architect
Farr Associates, Chicago

Owner
Christy Webber Landscapes, Chicago

Structural Engineer
Drucker Zajdel Structural Engineers, Inc., Naperville, Ill.

Steel Fabricator
Steel Sales & Service, Lansing, Ill. (AISC Member)

General Contractor
The George Sollitt Construction Co., Wood Dale, Ill.

Merit Award—Under $15M

TAXI² MIXED-USE DEVELOPMENT—DENVER

A lot of design expertise went into transforming a former taxi cab maintenance facility in Denver into an 18-acre masterplanned, mixed-use development. In fact, the developers deliberately brought together four different architects to create an intentional "crashing together" of minds, styles, and aesthetics.

The building—TAXI²—is the second building in a series that will redevelop a Denver brownfield site into a forward-thinking, live-work community. (Phase I was an adaptive reuse project that took the original taxi headquarters and turned it into innovative workspaces.) The project includes 100,000 sq. ft of commercial and residential space—and plenty of exposed structural steel.

The structrual engineer designed an extraordinarily light structural steel system: 7.6 psf in the first two stories, topped by structural light-gauge systems for the upper two floors of residential space. The steel frame includes 15-ft beam spacing to minimize the number of pieces, and thus erection time and cost. All structural steel elements, including beams, girders, columns, braces, and floor deck, are left exposed.

Another unique aspect of the project was that the electronic data produced by the engineer eventually fed the CNC-driven equipment at the fabrication shop. Building geometry and steel framing were produced in RAM Structural System, and the electronic information was fed to the SDS/2 3D detailing software, which in turn provided CNC information to the fabrication equipment.

Stair cores, the primary lateral resisting system for the building, were perhaps the most visibly innovative component of the project. Constructed with prefabricated leave-in-place steel forms, they were placed by the steel erector and later filled with concrete. The custom-designed, one-story prefabricated modules are designed to support the steel framing prior to concrete placement. This sequencing removed concrete from the schedule, allowing the steel erector to continue without waiting for other subscontractors. The presence of the steel floor deck prior to concrete placement allowed the contractor to use the deck as the working surface when placing concrete in the cores, and further saved time and money by preventing the need for scaffolding. Developed by Cortek Building Systems and designed by the structural engineer, this was the system's first-ever installation.

Architect of Record
Alan Eban Brown Architects, Eldorado Springs, Colo.

Design Collaborators
Will Bruder + Partners, Ltd., Phoenix
Harry Teague Architects, Basalt, Colo.
David Baker + Partners, Architects, San Francisco

Owner/Developer
Zeppelin Development, Denver

Structural Engineer
KL&A, Inc., Denver

Steel Fabricator
Western Slope Iron & Supply, Inc., Grand Junction, Colo. (AISC Member)

Steel Erector
LPR Construction Company, Loveland, Colo.

General Contractor
M.A. Mortenson Company, Denver

Patty Owens

National Award—$15M to $75M

NATIONAL MUSEUM OF THE MARINE CORPS—QUANTICO, VA.

The new National Museum of the Marine Corps illustrates a unique combination of architecture, symbolism, and geometry.

To successfully represent the honor, courage, and spirit of the Marine Corps, the designers drew inspiration from an enduring symbol of the Corps: the historic film footage (later immortalized in a statue) of a small group of Marines planting and raising the U.S. flag on Iwo Jima in 1945. The design uses the exact triangular geometry of that famous image.

Steel made the project possible, from the 150-ft-diameter skylight to the exposed, battleship-gray-painted steel observation structure and balconies in the museum's Central Gallery. The centerpiece, from a structural and symbolic standpoint, is the 210-ft.-long stainless steel-clad structural box beam that projects beyond the skylight at 60°, representing the flag pole. The piece tapers in section from about 15 ft by 17 ft at the base to 4 ft by 3.5 ft at the top.

For more on this project, see "What's Cool in Steel" in our August 2007 issue at **www.modernsteel.com/archives**.

Nick Merrick © Hedrich Blessing

Owner
Naval Facilities Engineering Command, Quantico, Va.

Architect
Fentress Architects, Denver

General Contractor
Balfour Beatty, Fairfax, Va.

Structural Engineer
Weidlinger Associates, Inc., Washington , D.C.

Steel Fabricator
Banker Steel Company, Lynchburg, Va. (AISC Member)

Merit Award—$15M to $75M

LAS VEGAS SPRINGS VISITORS CENTER—LAS VEGAS

The Visitor Center at the Las Vegas Springs Preserve is an interactive environment drawing upon the history of the site and surrounding Mojave Desert context.

The extensive use of exposed structure required a higher level of detailing than most projects with architectural finishes. The structural steel, interior screens, exterior shade structures, stairways, and awnings all required details that were sculptural in quality. The 72-ft diameter rotunda also featured a richly detailed, long-span roof system.

Nearly all of the elevated floor and roof framing in both buildings is architecturally exposed. Framing was organized and designed to create a handsome and efficient layout that is respectful of headroom requirements, particularly for architectural elements suspended from the roof.

An elliptical steel awning, measuring 33 ft from front to back and cantilevering more than 27 ft past its forward supports, forms the centerpiece of the main entry to the exhibit building. With a structure formed entirely of steel plates, the awning consists of three elliptical plates and a circular plate—each with a different center point along the front to back axis of symmetry—and a series of radial plates that create the appearance of a rising sun.

Architect
Tate Snyder Kimsey Architects, Henderson, Nev.

Owner/Developer
Las Vegas Valley Water District, Las Vegas

Structural Engineer
Leslie E. Robertson Associates, R.L.L.P., New York

Steel Fabricator
Southwest Steel (a division of SME Industries), Henderson (AISC Member)

General Contractor
J.A. Tiberti/Whiting Turner (a joint venture), Las Vegas

Tate Snyder Kimsey Architects

Merit Award—$15M to $75M

THE ORATORY AT AVE MARIA UNIVERSITY—AVE MARIA, FLA.

The Oratory at Ave Maria University is the focal element of a new town and university development on 4,000 acres of former agricultural land in southern Florida.

The Oratory's design was based on a traditional basilica form, built with modern methods and materials. The detail, structure, and finishes combine together to balance tradition and modernity. As one first sees the profile of the 120-ft-tall structure on the horizon, images and thoughts of a traditional cathedral are evoked. Moving closer to the Oratory, the clear distinction of a contemporary structure of glass, steel, and stone is revealed in greater detail. Entering the building through the narthex, the soaring height of the nave is compressed by the choir mezzanine above and then dramatically expands upon entering the nave proper. The eye is drawn up to the light penetrating from behind the lattice of steel above, creating a sense of mystery, the owner's primary design goal.

Steel "buttresses" are expressed from the interior to the exterior, as free-standing exposed steel frames penetrate the outer skin, hinting at the lattice steel bents that form the basis of the overall structure. In this building, the structure *is* the architecture and is the most prominent foreground element. The latticed steel bents take structural steel and infuse it with the delicacy of gothic tracery, intertwining the members to form the great steel frames from which the building form arises. Key intersections of steel members are lighted with punched openings to the exterior, thus the steel connection becomes a diffuser of natural light bounced across the interior spaces.

The integration of engineering, architecture, and construction is raised to an art form; all systems integrate to define and enrich the space. Mechanical systems, lighting, controls, and subsequent wiring are all integrated within the steel framing system and disappear into the overall composition. A critical decision made early in the design process, and based on fabrication and erection concerns, was the use of wide-flange shapes in lieu of HSS for the main members of the upright steel bents. The geometry of these bents is comprised of a latticed grid of radiused steel members that were curved using state-of-the-art computer-controlled rolling equiment.

Lateral loads are transferred to the 3-ft-thick mat foundation via a combination of flexural bending and arching action of the curved steel members. Stability analysis of the lateral framing was complicated by the members' curved geometry and unique connections, which made traditional effective-length and slenderness procedures ineffective. Lateral loads were determined by wind tunnel studies on a scale model of the building. These loads were applied to a three-dimensional finite element computer model that incorporated the Direct Analysis Model along with a P-Delta anaylsis to determine member forces and deflections.

Photos: New York Focus LLC

Architect/Structural Engineer
Cannon Design, Grand Island, N.Y.

Owner
Ave Maria University, Ave Maria, Fla.

Steel Fabricator
Cives Steel Company, Thomasville, Ga. (AISC Member)

General Contractor
Suffolk Kraf, Naples, Fla.

National Winner—$75M and greater

VIRGINIA BEACH CONVENTION CENTER—VIRGINIA BEACH, VA.

The Virginia Beach Convention Center is well suited to its location near the Atlantic Ocean, as architectural references to ships and sailing abound.

Exposed structural steel elements are used throughout the convention center as a common and unifying theme. A wide variety of architecturally exposed steel structures support the architectural vocabulary of modern, sleek, ocean-going vessels:

- ✓ A monumental pre-function entry area housed by a glass wall and cable-stayed mast trusses
- ✓ Glass roof scissor-frames in the pre-function area
- ✓ Long-span arched Pratt trusses and purlins over the exhibition hall spaces
- ✓ A 150-ft-tall steel-framed observation tower with high transparency
- ✓ Exterior exposed steel louver support frames at the entry to ballroom.

The entry glass support structure is a unique system of lens-shaped mast trusses spaced 15 ft on center and spanning vertically some 70 ft. These cable-stabilized trusses are composed of hollow pipe section masts with cruciform outrigger arms defining the doubly parabolic shape. Each truss is outfitted with an articulated pin assembly at both the top and bottom of the truss, nicely complementing the nautical theme of the center as a whole. Mast trusses are spaced along the entire length of the pre-function space, some 700 ft in length. The structural steel supports for the glass entry pre-function area gracefully provide for a light-filled, airy design aesthetic.

The long-span roof trusses over the exhibition hall space were shipped to the site in individual pieces, assembled on the floor of the hall in the lay-down position with specified cambers, and then lifted into place as an entire assembly without temporary support towers. All structural steel trusses, ceiling and roof purlins, diaphragm bracing, and roof decking are left entirely exposed in the final built condition, keeping consistent with the notions of exposed structure and inherent strength throughout the facility.

For more on this project, see "Ocean View" in our October 2007 issue at **www.modernsteel.com/archives**.

Owner
City of Virginia Beach, Va.

Architect/Structural Engineer
Skidmore, Owings & Merrill LLP, Chicago

Steel Fabricator
Cives Steel Company, Winchester, Va. (AISC Member)

General Contractor
Turner Construction, New York

Photos: Steinkamp Photography/James Steinkamp

Merit Award—$75M and greater

BRONX COUNTY HALL OF JUSTICE—BRONX, N.Y.

The Bronx County Hall of Justice stands prominently on a two-block site facing East 161st Street near Grand Concourse, a major civic thoroughfare in the Bronx. The L-shaped building houses 47 courtrooms, seven grand jury rooms, and offices, and provides underground parking for 240 vehicles.

While natural light and views were desirable, heightened security requirements demanded protective design. The Hall of Justice balances these concerns by expressing the judicial system's openness and transparency through a translucent curtain wall that is also blast-resistant.

Along 161st Street, an accordion-fold curtain wall features fritted glass in three horizontal bands of varying transparency. Structurally, the saw-tooth curtain wall is shaped primarily by aluminum mullions but is reinforced at strategic points with steel. The "V" shape gives the wall added stiffness and helps it to deflect and absorb blast forces, with laminated glass units used to reduce the likelihood of shattering. These units are attached to the frames with structural silicone to ensure that the glass is retained in the frame in the event of blast loading. Steel-frame structures are inherently more flexible than concrete, and thus able to distribute shock loading more easily, providing a further measure of safety.

A one-story-high transfer truss enables an 80-ft-wide, column-free lobby at ground level, reminiscent of vast traditional courthouse vestibules. Above, with slab-to-slab heights of 18 ft, the courtrooms are 40-ft, column-free spaces that possess a similarly commanding, yet appropriate, sense of scale. Ancillary rooms for attorney-client conferences, witnesses, jury deliberation, and judges' robing rooms flank the courtrooms on both sides; the lower ceiling height of these rooms (8 ft) permits light to pass over and filter inward, illuminating the courtrooms.

The floor slabs cantilever 20 ft on either side of the courtrooms, creating column-free perimeter circulation zones: a private zone for judges on one side and a public zone on the other. On the public side of the building, portions of the upper-story slabs cantilever 30 ft, with feature stairs suspended from the slab ends. Pairs of hollow, 10-sq.-in. steel trusses, along with 5-in. by 10-in. vertical hangers that attach to the staircases, hang beneath the cantilevers to support the public feature stair. These architecturally expressed structural members are visible from the outside of the building. The trusses are welded together, sanded smooth, and coated with a white intumescent paint for fire protection. Leaving the trusses exposed allows additional light to enter the circulation zones through the plaza-side glazed curtain wall.

Additionally, a two-story cylindrical jury assembly building in the courtyard gives scale to the plaza and is a visceral symbol of the true seat of justice, clad in precast concrete to contrast with the rest of the building. The cylindrical, steel-framed volume is structurally independent of the rest of the building.

Architect
Rafael Viñoly Architects PC, New York

Associate Architect
DMJM + Harris, New York

Owner
Dormitory Authority of the State of New York Corporate Headquarters, Albany, N.Y.

Structural Engineer
Ysrael A. Seinuk PC, New York

General Contractor
Bovis Lend Lease, New York

Paul Warchol Photography, Inc.

Presidential Award of Excellence

STATE BAR OF CALIFORNIA BUILDING—SAN FRANCISCO

The State Bar of California seismic strengthening project exemplifies the use of structural steel to improve the seismic performance of a 13-story 1970s reinforced concrete building in high-seismic San Francisco. The project employed a state-of-the-practice seismic-mitigation technology and a number of other innovations to cost-effectively mitigate a very undesirable primary characteristic in the response of the existing structure to strong earthquake shaking. The defect involved the expected performance of the tall ground story, which was predicted by nonlinear response history analyses to experience large inter-story drifts and significant inelastic behavior verging on collapse in the event of a large earthquake. The building owner/occupant, the State Bar of California, desired improved seismic reliability if it could be achieved without severely disrupting operations, and embarked on a voluntary effort to mitigate the seismic hazard.

The most cost-effective and least disruptive solution that targeted the defect and avoided wholesale upgrading consisted of the addition of buckling-restrained bracing—infilled within new structural steel WT framing—to the lowest three stories of the existing perimeter reinforced concrete moment frame. This was the first application of this technology for seismic retrofit of a concrete building within the city of San Francisco. Buckling restrained braces consist of a ductile structural steel core located within a grout-filled HSS; the core is isolated from the grout by a bond-breaker, which enables the steel core to deform and yield without engaging the surrounding HSS. As the name implies, buckling restrained braces exhibit very stable hysteresis relative to other steel bracing systems, because they can yield in a ductile manner in both tension and compression. Furthermore, because the material properties of the core steel are tightly controlled, the strength of the braces is very predictable.

The design of the infilled diagonal bracing system, including the new steel framework and its attachment to the existing concrete frame, was predicated on a capacity analysis of the braces and iterative performance analyses of the building. Essentially, the maximum force that can be developed by each brace (i.e., the strength of each brace) was identified, and the whole of the supplemental system was designed for those computed forces using LRFD with lower bound yield strengths and associated phi factors. As a result, other than the desired yielding expected to occur in the new buckling-restrained braces, the supplemental system of steel framework is not expected to experience yielding even in the maximum considered earthquake event.

For more on this project, see "Braced for the Big One" in our August 2007 issue at **www.modernsteel.com/archives**.

Architect/Structural Engineer
Wiss, Janney, Elstner Associates, Inc., Emeryville, Calif.

Associate Architect
Richard Pollack Architects, San Francisco

Owner
The State Bar of California, San Francisco

General Contractor
Turner Construction Company, San Francisco

Photos: Wiss, Janney, Elstner Associates, Inc.