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, 2008 and December 31, 2010;
- 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

From left: Zimmerman, Klemens, Walls, Long, Theel, Tofighi, Schneider

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 one project for the Presidential Award of Excellence in recognition of distinguished structural engineering.

2011 IDEAS² Awards Jury ➤

➤ **Kent Long**, P.E., joined Dallas-based Balfour Beatty Construction in 1988 and has experience as a project engineer, chief estimator, project manager, vice president of estimating, senior vice president business acquisition and currently as senior vice president of federal projects for the Southeastern U.S.

A licensed professional engineer, he is particularly strong in civil and structural design analysis. In his current role, he oversees the strategic marketing, business development and operational execution efforts of the federal market in the Southeast.

Long is the past chairman of the Associated Builders and Contractors Florida East Coast Chapter and is currently the incoming president for the South Florida Society of American Military Engineers.

He earned a Bachelor of Science in Civil Engineering from the University of Missouri and a Bachelor of Science in Construction Management from the University of Louisiana at Monroe.

➤ **Jay W. Schneider** is editor of *Building Design+Construction*, an SGC Horizon publication based in Arlington Heights, Ill. *BD+C* serves more than 75,000 architects, engineers, contractors, building owners, and real estate executives. The magazine has won four Jesse H. Neal Awards, as well as accolades from the American Society of Business Publication Editors (ASBPE) and the Construction Writers Association.

Schneider received an Honorable Mention from the Construction Writers Association's Kneeland Godfrey Award for Body of Work category in 2007 and 2009. He was elected to the Construction Writers Association board in 2009.

Prior to joining *BD+C*, Schneider was an editor for Elmen Publications, San Rafael, Calif., and Hanley-Wood Inc., Washington. He is a graduate of Syracuse University.

➤ **Robert P. Theel**, AIA, serves as the U.S. General Services Administration's chief architect in the six-state Great Lakes Region headquartered in Chicago. He is the senior advisor to the regional administrator of GSA and the regional commissioner of the Public Building Service (PBS) regarding federal architecture, design, construction policy and innovation. He provides leadership for the regional design and construction programs for U.S. courthouses, federal office buildings and border stations.

Theel is a graduate of the Illinois Institute of Technology and has served the government as a design architect, project manager and design director prior to establishing the position of chief architect for the Great Lakes Region of GSA in 1999. In 2005, he was also appointed director of the regional Design & Construction Division. For his role in establishing and supporting GSA's Design Excellence Program, Theel is a recipient of GSA's "Excellence in Public Architecture" award.

➤ **Farro Tofighi**, P.E., is a managing principal at DeSimone Consulting Engineers. He joined the firm in 2005 to help open its Las Vegas office. His dedication to the field of structural engineering and excellent client service is an integral part of his firm's business ethics.

Tofighi has more than 25 years of experience that covers a broad range of project types including office buildings, high-rise condominiums, educational facilities, entertainment complexes, and hospitality and gaming facilities. He has extensive experience in seismic design standards and three-dimensional dynamic analysis of complex and specialty structures. For the past 15 years, Tofighi has been involved in the structural design of many leading Las Vegas hotels and casinos as well as non-gaming projects.

He received his Bachelor of Science in Civil/Structural Engineering from Northeastern University in Boston and is a registered professional engineer in several states. He is an active member of AISC, Structural Engineers Association of Nevada and California, and the International Code Council. Tofighi is also currently serving as the co-chairman of the Southern Nevada Building Code Committee.

➤ A founding partner and lead designer for Little Rock, Ark.-based Polk Stanley Wilcox Architects, **Wesley Walls**, AIA, has helped elevate the firm to high standard of design excellence. Walls has been recognized for his work with numerous state, regional and national awards. His creative and innovative talent has earned him a strong reputation in the architectural community, and his attention to detail and schedules is predominant in all of his projects.

With more than 20 years of experience, he has led the firm's focus on higher education and research commissions. In the past year alone, Walls managed more than $100 million in successful projects of all sizes and complexities. His recent work includes the One-Stop Student Services building at the University of Arkansas at Little Rock; the College of Public Health building and the Psychiatric Research Institute at the University of Arkansas for Medical Sciences; and the Faculty Office Building at the Arkansas Children's Hospital. Walls earned his Bachelor of Arts in Architecture at the University of Arkansas.

➤ **Duff Zimmerman**, P.E., is the manager of operations with AISC member Cooper Steel Fabricators Inc., Shelbyville, Tenn., an AISC-certified, full-service steel fabrication and erection company.

He currently serves on the Steel Erectors Association of America (SEAA) board as immediate past president. Zimmerman has been the editor of The SEAA Connector magazine. He is also a member of the AISC Research Committee and TI/BIM Committee. He has been a member of the AISC Safety Committee and been a presenter at the NASCC: The Steel Conference. He holds a Bachelor of Science degree from the University of Tennessee in Civil Engineering.

➤ **Thomas L. Klemens**, P.E., is senior editor of *Modern Steel Construction* magazine, published by the American Institute of Steel Construction, Chicago. His editorial career spans two decades with a variety of engineering and construction related magazines.

Prior to entering the publishing field, Klemens worked as a structural engineer with the Chicago-based consulting engineering firm Sargent Lundy, spending nearly three years on site at the Braidwood (Ill.) Nuclear Power Station. He also was a project manager for Northwest Group, one of the contractors involved in construction of the United Airlines terminal at Chicago's O'Hare International Airport, and a field engineer with highway and bridge contractor S.J. Groves and Sons, Minneapolis. Klemens also is an adjunct instructor at Harper College, Palatine, Ill.

National Award—Greater than $75 Million

MINETA INTERNATIONAL AIRPORT TERMINAL B AND CONCOURSE, SAN JOSE, CALIF.

Combined, the new concourse and Terminal B at Mineta San José International Airport (SJC) stretch more than 2,100 ft—the length of seven football fields—with soaring spaces up to 55 ft high. Although limited by site constraints to just a 90-ft width, the 1,600-ft-long concourse adds 380,000 sq. ft of passenger space, with ticketing, security, retail/dining, baggage operations, support space, and new departure curb. Terminal B, which is 254,028 sq. ft on thee levels, has been designed for future phased expansion in the form of a 12-gate south concourse.

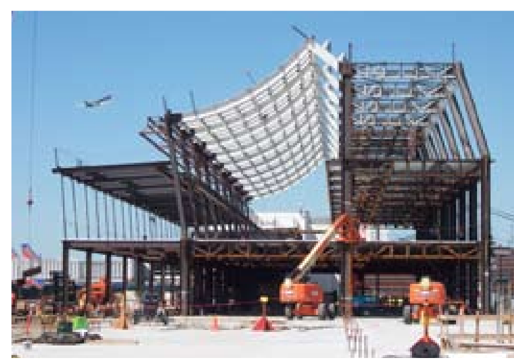
The need for the new structure had become apparent by the late 1990s. The airport was undersized, outdated, and at risk of losing resident airlines. Fearing the negative impacts from that for itself and area businesses, the airport hired architectural firm Gensler to undertake master planning. Ultimately, the San José City Council approved a $4.5 billion, 12-year modernization program. The scope and small site—tightly bounded on six sides by a river, roadways, FAA regulations, and a high water table—presented significant challenges.

Work began first on a new concourse building, with Gensler leading the design team which included Steinberg Architects and Magnusson Klemencic Associates (MKA) as structural, seismic, and blast engineer. To meet the owner's goals of long-term space planning flexibility and operational efficiencies, MKA developed a structural system never before used at a major airport known as a "special truss moment frame" (STMF).

The brace-free openness of the STMF system provided several significant benefits:

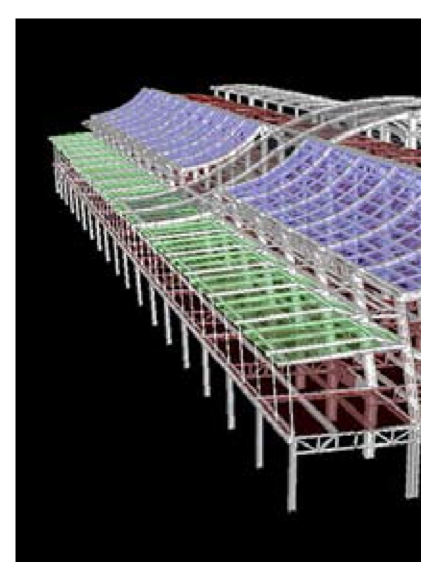
- Extremely ductile and robust performance during a seismic event, important given the airport's location in the most active and populous earthquake area in the U.S.
- Accommodation of restrictive site geometries while fitting all desired program elements.
- Increased architectural freedom and layout flexibility, both initially and in the future, with simplified routing of ducts, pipes, and conduits in the spaces between the diagonal trusses and center segment.
- Triple-duty performance, resisting gravity and earthquake/wind loads in one system.
- Simplified erection, with STMF components delivered preassembled and erected with bolts and fillet welds.

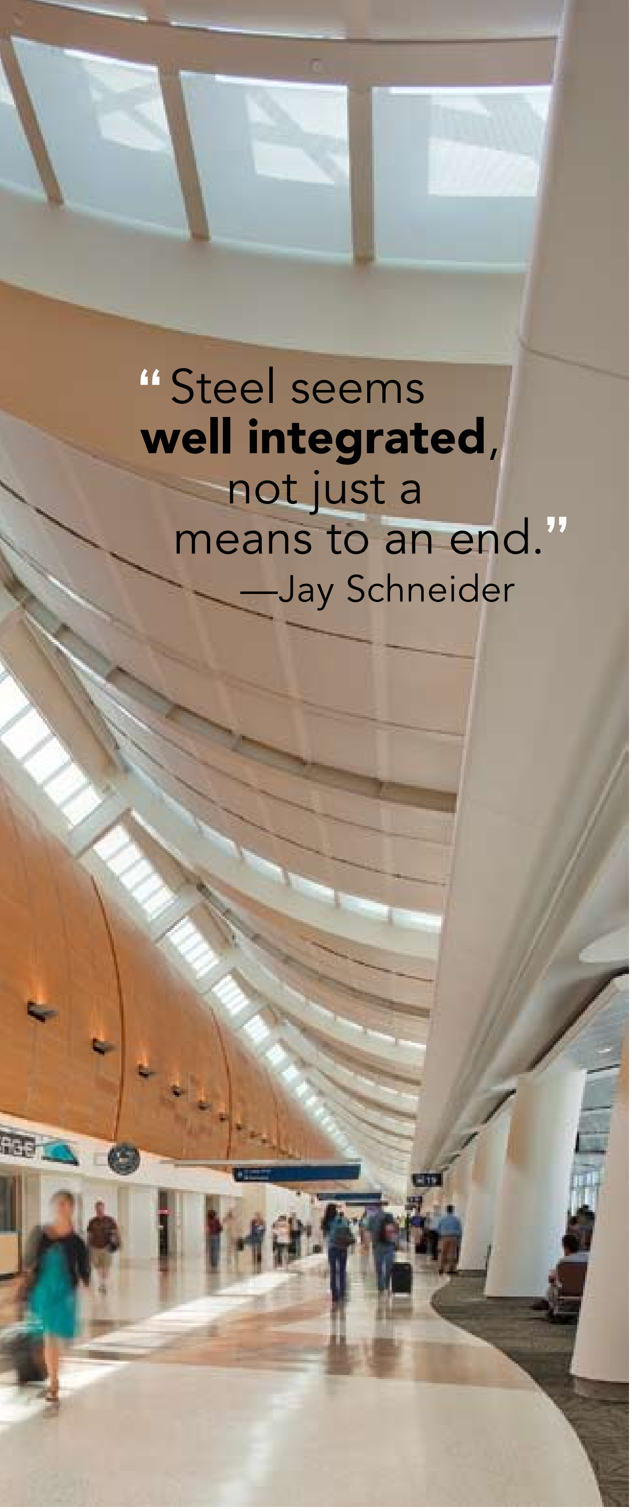
Just as Clark Construction began erecting the concourse, aviation business at SJC was challenged by the terrorist attacks on 9/11/2001 and the dotcom decline, and the modernization program beyond the new concourse building was put on hold.



With the owner's desires reined in by new economics, the design team implemented a revised $1.3 billion, 3-year improvement program—with similar scope but at one third the cost and on a compressed schedule. Terminal B was prioritized as the next project and proceeded using a design/build approach led by contractor Hensel Phelps with Fentress Architects to accelerate the schedule, minimize costs, and reduce risks.

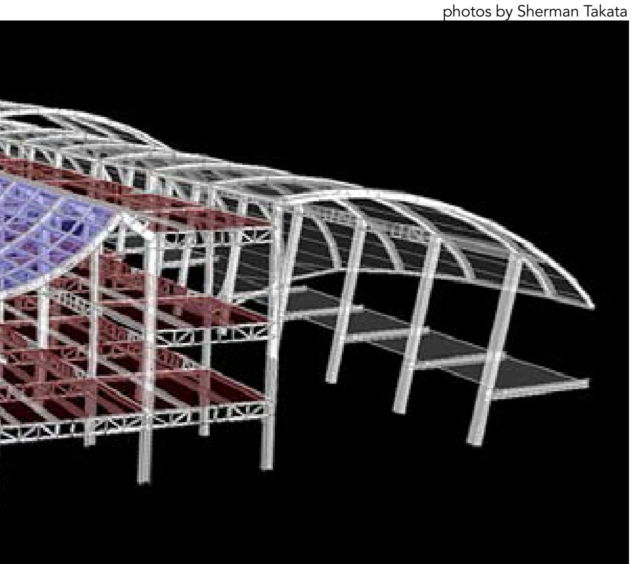
A value engineering review by the HP team discovered that if Terminal B were moved several hundred feet from its location in the master plan and physically connected to the still-under-construction concourse, substantial economic and operational benefits could be realized. This relocation and revision was possible only due to the adaptability of the STMF system. The acceleration of design for Terminal B and the HP team's idea of shifting the terminal immediately adjacent to the concourse meant that the terminal's structural system had to be designed well before its architectural layout had been established. MKA's solution was to use the highly adaptable STMF system from the concourse in Terminal B as well. That allowed the structural system for Terminal B to be designed and early construction packages issued for excavation and structural steel before the architectural layout was completed.





"Steel seems **well integrated**, not just a means to an end."
—Jay Schneider

photos by Sherman Takata



Ultimately the two buildings were tied together without the need for new foundations, with minimal additional reinforcing, and without a separating building joint and corresponding double row of columns.

Engineers also "disconnected" the Terminal B roof from the concourse to minimize potential damage during a major earthquake. Wherever the arched roof ribs touch down curbside, they are supported on three Teflon-coated elastomeric bearing pads that allow up to 28 in. of horizontal movement.

Another cost savings was realized in the way the curved architectural features were achieved. Creating the architectural building shapes found in Terminal B and the concourse out of uniquely curved steel members was possible, but prohibitively expensive. Instead, engineers employed nontraditional straight-line generation techniques. In areas where a "ruled" surface existed, systems were designed with straight members in one direction and curved in the other. When curved members were necessary, parametric and costing studies optimized spacing and minimized the number of curved pieces, and the radius of a curve was repeated where possible to minimize set-up time and fabrication costs.

For architectural "feature walls," cladding elements were supported on metal deck bent naturally along its weak axis to form a curve. Terminal B was designed using curved steel roof girders spanning 100 ft and spaced 30 ft on center. In the concourse, leaning Y-shaped columns on 30-ft centers support curved roof beams, with additional steel members parallel to the length of the concourse.

Terminal B and the concourse both were delivered under budget and ahead of schedule. Terminal B is expected to receive LEED Silver, and the concourse already has.

Owner
Mineta San Jose International Airport, San Jose, Calif.

Architect – Terminal B
Fentress Architects, San Jose, Calif.

Architect – Concourse
Steinberg Architects, San Jose, Calif. / Gensler, San Francisco

Structural Engineer
Magnusson Klemencic Associates, Seattle (AISC Member)

Steel Fabricator
Gayle Manufacturing Company, Woodland, Calif. (AISC Member)
Beck Steel Inc., Lubbock, Texas (AISC Member)

Bender/Roller
Chicago Metal Rolled Products Company, Chicago (AISC Member)

Steel Erector
California Erectors, Benicia, Calif. (IMPACT Member)

General Contractor
Clark Construction Group, LLC, Oakland, Calif.

Design-Build Contractor – Terminal B
Hensel Phelps Construction Company, Los Angeles

Structural Software
Revit, SAP2000

National Award—Greater than $75 Million

NATIONAL ALABAMA CORPORATION RAILCAR MANUFACTURING FACILITY, CHEROKEE, ALA.

Photos: Justin Maconochie

Upon completion in 2009, National Alabama Corporation's 2.1-million-sq.-ft railcar manufacturing facility immediately set the standard for other railcar facilities to emulate. Housing fabrication, construction, finishing and administration operations under one roof, the facility is capable of producing up to 12,000 cars annually.

Located on 635 acres in Barton Riverfront Industrial Park in Cherokee, Ala., the facility's orientation followed the existing topography, which minimized site grading, allowing natural areas to remain untouched. The north-south orientation of the facility takes full advantage of sunlight for natural lighting opportunities. The facility accesses the Norfolk-Southern rail line along its southern boundary and a 500-car capacity storage yard was constructed east of the manufacturing facility. Steel rail sidings connect to the existing rail line to facilitate delivery of completed railcars.

Constructed at a cost of approximately $300 million, the project recorded many impressive construction statistics. More than 22,600 tons of structural steel was erected in a remarkably short period of just four months. The superstructure included 27,000 pieces of steel, 200,000 bolts, three miles of handrail and more than five miles of crane runways. The manpower effort included more than 50,000 detailing hours and 305,000 fabrication hours. Four erection crews with four crawler cranes worked concurrently to keep pace with the arrival of 100 truckloads of steel per week, enabling the installation of an average 1,600 pieces per week.

From the earliest planning stages, it was clear the facility design needed to provide maximum flexibility to accommodate concurrent production of multiple styles of railcars. With railcars measuring nearly 90 ft long, 20 ft high and weighing close to 70,000 pounds, it was evident that only a steel structure could provide the long-span and clear heights necessary to meet this critical program requirement. Due to the size and weight of even the simplest components, the fabrication and construction of railcars uses cranes extensively for material handling. The construction area of the facility incorporates jib cranes, semi-gantry and gantry cranes, as well as top-running bridge cranes, all of which are integrated into the building in a complex marriage of process and building structural elements. Typical bay size parallel to the process flow was set at 30 ft to optimize crane runway support framing. Bay sizes perpendicular to the process flow ranged from 93 ft to 120 ft with the majority being 103 ft or 120 ft. Roof trusses were used to span the long direction with bar joists or wide-flange beams spanning the 30 ft.

During initial scheduling discussions it became apparent that procurement of structural steel was on the critical path. The project design team engaged a structural steel fabricator and erector very early in the design process, allowing for optimization of the structural steel design and streamlining of the procurement process. Applying their joint expertise to the fullest extent, the project team produced a structural steel mill order in less than a month while still in the schematic design phase. This extraordinary joint effort enabled the project team to meet a window in the steel mill production, avoiding a three-month delay in schedule.

By modernizing a design innovation first implemented by Albert Kahn himself a century ago, the structural engineering firm created a 2,000-ft-long roof monitor over the construction area that not only functions as an enormous glass skylight but also ventilates heat through its built-in louvers. Louvers located along the facility's lower perimeter walls work in tandem to create a natural draft by pulling cooler air in below while hotter air escapes above.

The design uses single columns to support the roof and crane girders in lieu of separate building and crane columns. The crane girder support brackets were shop fabricated integrally with the column to minimize effects of fatigue and

eliminate the possibility of laminar tearing of the flanges. That also reduced the number of erected pieces, shortened the erection schedule and simplified the support of the multiple levels of cranes as well as the continuous 8-ft-wide equipment platform straddling the column.

Although the manufacturing process is linear, a need existed for lateral movement of parts, tooling and jigs between parallel production lines. Where required, these 90-ft-long, 18-ft-high openings necessitated the elimination of two crane/building columns at each crossover. Large transfer trusses weighing 25 tons were utilized at the roof to support the roof as well as supporting the crane girders at 30-ft intervals. Hangers replicating the typical crane column in size and detailing were connected to the transfer truss and used to support the two levels of crane girders and the equipment platform. This approach eliminated the need for "special" plate girders that otherwise would have been required to span the 90-ft opening.

The design of the administration building required roof cantilevers of up to 22 ft and floor cantilevers of up to 12 ft while minimizing the depth of structure. This, obviously, could only be accomplished using steel. Visualize Wright's Falling Water but without the cracks in the structure.

Aesthetically the building embodies stylistic elements from the golden age of American industrial design, the strong linear character associated with railway functions and the NAC brand image. Horizontal metal panels and glass bands are the primary exterior materials. The facility incorporates broad expanses of glass curtain wall and roof monitors that permeate the manufacturing spaces with daylight and natural ventilation. The south façade of the facility is a celebration of glass and classic industrial plant design for which Kahn is renowned. This exit for finished railcars has a transparency and light quality rarely seen in conventional industrial facilities. The result is a design that is functional while maximizing sustainable design and optimizing the work environment to achieve an efficient, collaborative and inspiring image for National Alabama Corporation.

This facility is expected to achieve LEED Silver certification, and in so doing, may become the largest industrial project to achieve this distinction in the new construction category. One example of the many sustainable design features incorporated into the NAC facility is the harvesting of rain water from more than 37 acres of roof and hard surface areas and diverting it to a two-acre irrigation pond. The extensive use of steel in the facility is inherently sustainable as a highly recyclable product that can be transformed many times over and gain new life when combined with other materials. A great example of resource reuse can be seen in the railcar storage yard. This area incorporated more than eight miles of reused steel rail sections, rescued from the scrap yard and recycled, along with steel rail ties, to form the storage yard rail spurs. This used rail was also incorporated into the facility production lines, reducing costs and conserving natural resources.

Spanning nearly ¾ of a mile in length, and made possible with innovative structural steel design and construction, NAC's railcar manufacturing facility is a marvel of modern industrial architecture. The fusion of function, form and sustainable design creates a flexible production environment with a reduced carbon footprint that will endure for decades.

Owner

National Alabama Corporation, Cherokee, Ala.

Architect and Structural Engineer

Albert Kahn Associates Inc., Detroit (AISC Member)

Steel Detailer

McGill Engineering, Inc., Tampa, Fla. (AISC Member)

Steel Fabricator

Cives Steel Company, Roswell, Ga. (AISC Member)

Steel Erector

Midwest Steel, Inc., Detroit (AISC Member)

General Contractor

Yates-Walbridge Joint Venture, Philadelphia, Miss.

Joist Manufacturer

Quincy Joist Company, Quincy, Fla. (AISC Member)

Structural Software

RISA-3D, RAM Structural System


Photos: David deArmas/Moed deArmas & Shannon

Merit Award—Greater than $75 Million

510 MADISON AVENUE, NEW YORK

510 Madison Avenue is a 429-ft-tall, 30-story boutique office building on East 53rd Street in the Plaza district of Midtown Manhattan. This modernist tower provides clean façade lines and flexible interior spaces for tenants. The project is pursuing LEED Gold certification. The building includes a fitness club with 50-ft pool and a private restaurant, both reserved for tenants and their guests, along with a large landscaped terrace overlooking Madison Avenue. The upper office floors have views to Central Park.

The building sounds like any other plain vanilla office building until you look more closely. The structural steel virtually disappears, taking up less floor space and providing additional headroom. This is not a traditional economical structure where the lightest steel members were selected to reduce the steel tonnage. Rather it is a modern, value-driven structure, providing the most value for the owner by squeezing the structure, opening up the floor area, raising the ceiling and letting aesthetic requirements control the design.

510 Madison is engineered to allow open column-free floors. Trusses and transfer girders connect the tower—seventh floor and above—to the base, allowing the tower floors to cantilever over the adjacent building to the west. The upper floors have no interior columns, while the lower floors have only three.

The typical floor-to-floor height is 13 ft, 6 in. which allowed for 10-ft clear height to the finished ceiling. Floor slabs are constructed of 2.5-in. normal-weight concrete over 3-in., 18-gage metal deck. Floor framing members are designed to work compositely with the floor slab, and typically span approximately 55 ft. These beams are limited to W18 series to allow maximum headroom with future flexibility.

The building core is compactly located on the south side of the tower. The core is surrounded by steel braced frames which were carefully coordinated with the design team to provide adequate door opening clearances and passages for ductwork from the mechanical room. All building columns are engaged in the lateral load resisting system.

The braced frames incorporate outrigger trusses at the 6th and 30th floors providing lateral stiffness in the north-south direction. Braced frames combined with moment frames along the north and south sides provide resistance in the east-west direction. The braces are wide-flange sections ranging from W14×53 to W14×500. The design was also assessed for multi-hazard, progressive collapse resistance.

The perimeter columns are disengaged from the glass; the façade is anchored into the slab edges. Spandrel beams are W30s with round openings through the web for sprinkler line access to the glass façade.

The truss at the 6th floor is supported by 6-ft, 9-in.-deep built-up plate transfer girders in the ceiling of the fifth floor to reduce the number of interior columns in the lower floors.

“**Value-driven** steel design—
what a concept!”
—Tom Klemens

The site was studied in a wind tunnel. Using that data and the building properties, engineers at the Boundary Layer Wind Tunnel Laboratory at the University of Western Ontario performed desktop studies and determined the controlling design parameter was to limit torsion at the top-most corner office space.

The fitness club in the cellar is accessed by an architecturally exposed steel stair. The skylight over the pool and the glass footbridge leading from the elevators to private dining are also framed using steel.

GMS designed all the steel connections, provided special inspection of the steel and served as the façade consultants.

Owner
Boston Properties, New York

Developer
Macklowe Properties, New York

Design Architect
Moed deArmas & Shannon, New York

Architect of Record
SLCE Architects, New York

Structural Engineer
Gilsanz Murray Steficek, New York (AISC Member)

Steel Detailer
WSP Mountain Enterprises, Sharpsburg, Md. (AISC Member)

Steel Fabricator
Banker Steel Co., LLC, Lynchburg, Va. (AISC Member)

Steel Erector
Helmark Steel Inc., Wilmington, Del. (AISC Member)

Construction Manager
Tishman Corporation, New York (AISC Member)

Structural Software
ETABS, RAM Steel, SAP

National Award—$15 Million to $75 Million

GATEWAY CENTER, WESTCHESTER COMMUNITY COLLEGE, VALHALLA, N.Y.

photos by Goldberg/Esto Photographics Inc.

The Gateway Center is a 70,000-sq.-ft academic building on the Valhalla, N.Y., campus of Westchester Community College. The three-story building houses a welcome center, classrooms, offices, computer and language labs, an auditorium, and a café. Construction was completed in fall 2010 for a total cost of $33 million, and received LEED Gold certification.

The heart of the project is a 48-ft-tall glass cube that creates a striking lobby and connects the north and south wings at two levels. Early in the project, the team began to pursue a modular design, using prefabricated elements in a kit-of-parts approach. Ultimately, the structure and architecture of the lobby became the expression of a manufacturing process. Although this idea has been explored in various ways, including through the use of shipping containers in building construction, the team settled on a more customized approach: 233 architecturally exposed structural steel (AESS) "boxes" were assembled to create a light, transparent volume. The boxes were fabricated from channels and plates and based on eight basic templates to maximize repetition and efficiency in the shop. Almost all field connections were made with shims and bolts, minimizing field welding and cutting erection time. Curtain wall connections were made to steel plate tabs that were attached to the boxes in the shop.

In addition to the boxes, the main lobby staircase and the bridge between the north and south buildings are AESS, with laminated glass treads and flooring. The bridge is supported in part by two steel hanger rods, which connect to the main stringers with custom pin and jaw fittings.

At the northern end of the building, the third floor cantilevers out over its base on all sides, with cantilever lengths varying from 6 ft to more than 30 ft. On the east side of the building, where the largest overhang occurs, the floor is hung from four steel roof trusses which also form a parapet wall to screen rooftop mechanical units from view.

The original design included a cantilever of more than 40 ft on the west side of the building. As part of a value engineering effort, the roof trusses in this area were eliminated, and an additional support was provided to reduce the cantilever to 24 ft. This additional support is an AESS element in an inverted tripod configuration, with three legs supported on a steel column that is embedded in a concrete wall below. Each leg of the tripod consists of two parallel plates stitched together at regular intervals with round spacer bars, creating ladder-like elements. To eliminate bending forces in the tripod, each leg terminates in a steel pin detail. The 4–in.–diameter pins are tied together at the base by a plate assembly designed to transmit gravity and lateral forces to the concrete structure below.

Steel was also chosen for an architectural sunscreen to shade the south facing façade of the north wing. The screen, approximately 19 ft tall and 160 ft long, was assembled from 13 separate panels that hang from steel supports cantilevered off the main building structure. Each panel provides shade with a field of closely spaced horizontal ⅜-in.-diameter steel tubes supported within X-shaped frames formed with steel plate. Panel connections to the base building were designed to accommodate movement due to thermal expansion and contraction.

Adjacent to the south wing of the building is one of the project's most prominent features, a 60-ft-tall tower built of steel and clad in zinc panels. The structure tapers from 10 ft wide at the base to less than 3 ft at the top and consists of two interconnected plates built up into an 18-in. overall cross section. Along the east-facing narrow edge of the tower is a full-height LED, allowing the tower to serve as a beacon for the entire campus at night as well as during the day.

Owner
Westchester Community College, Valhalla, N.Y.

Architect
Ennead Architects, New York

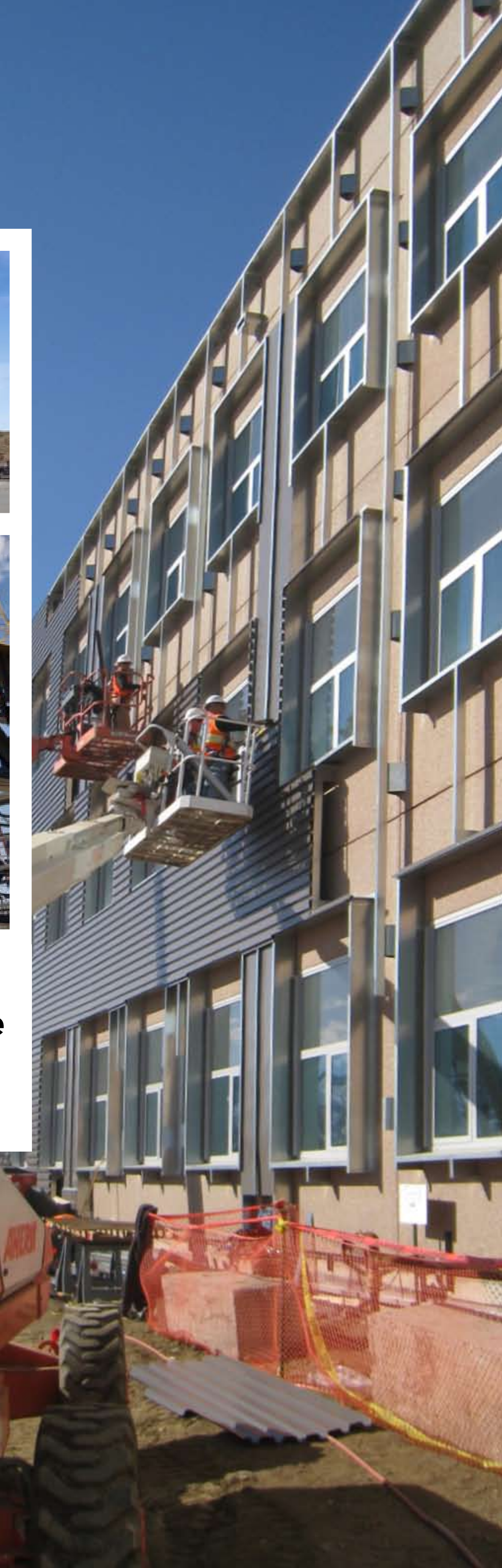
Structural Engineer
Leslie E. Robertson Associates, New York (AISC Member)

Steel Detailer
JCM & Associates Ltd., Frankford, Ontario, Canada (AISC and NISD Member)

Steel Fabricator
R & S Steel, Rome N.Y. (structural steel) (AISC Member)
Manufab, Kenner, La. (sunscreen panels) (AISC Member)

General Contractor
Worth Construction Company, Bethel, Conn.

Structural Software
ETABS



"Reuse of salvaged pipe was particularly **appropriate** for this energy lab structure."

—Tom Klemens

photos by Frank Ooms Photography

National Award—$15 Million to $75 Million

NREL RESEARCH SUPPORT FACILITY, GOLDEN, COLO.

Striving to become a model for building efficiency and net-zero energy design, the 222,000-sq.-ft NREL Research Support Facility (RSF) in Golden, Colo., identifies and addresses issues of building sustainability on multiple scales. Large-scale building components like form and orientation are rooted in passive solar design principles using the natural and predictable processes of the earth to give the RSF an energy advantage over traditional office buildings. Smaller scale solutions using active energy generating systems and both innovative new construction materials as well as recycled materials help the RSF target aggressive energy goals culminating with the desire to be a net-zero energy office building.

The building form is best described as a lazy H with long narrow wings maximizing north-south exposure. This exposure and thin profile allows the interior office spaces to be naturally ventilated and receive 100% daylight, greatly reducing mechanical energy consumption.

The insulated precast concrete panels and zinc cladding are both attached to the steel frame structure. By painting the exposed concrete and structure white, many of the interior spaces, including all of the office spaces, need no interior gypsum board. Louvers and shade boxes are built around the triple-glazed, thermally broken windows balancing the solar heat gain while allowing daylight to penetrate deep into the space after passing through a light louver system. To produce an even spread of light, interior columns are eliminated while long-span steel trusses rest on perimeter columns. The steel decking runs perpendicular to the exterior walls to reduce any potential daylight from being lost in the ridges and valleys of the deck.

The perimeter columns are recycled natural gas pipe harvested from fields in Louisiana. Now rather than extracting fossil fuels deep underground they are the literal pillars of strength of a building supporting the effort to minimize the impact of human life on earth through research and development. One of those developments at NREL led to the invention of the transpired solar collector, a steel panel used as part of the exterior cladding on the RSF. The panel is perforated such that natural convection draws outside air into the cavity between the panel and the thermally massive, insulated precast concrete panels. In the cool months this air is naturally preheated before entering the building, reducing the temperature differential between indoor and outdoor air. This panel along with the nightly purging of the building through operable windows keeps the RSF at temperatures close enough to human comfort levels that a traditional HVAC system is not required. However, to account for the remaining minimal heating and cooling needs of the RSF, approximately 42 miles of radiant tubing runs through the floor of the building. Uncharacteristically the radiant tubing propagates the conditioned air down to the space below using the exposed steel decking as a medium to evenly distribute this conditioned air through the space.

To help compensate for the remaining energy needs, the RSF has 1.6 MW of photovoltaic panels installed directly to the standing seam steel roofing. The power generated by these photovoltaic panels is dedicated for use by the RSF. The RSF is expected to perform 50% better than the ASHRAE 90.1 2004 standard and expects an energy use of 35 kBtu per sq. ft per year.

With expansive views of the Rocky Mountains and bright, collaborative workspaces, the RSF hopes to change the culture of the modern workplace. Rather than high partitions and closed offices, the open floor plans allow the RSF to remain flexible and encourage social interaction. Workstations are located within 30 ft of windows and employees are able to ventilate the office when conditions are favorable. Huddle rooms are provided for meetings and sensitive conversations that require acoustical privacy. The improved lighting conditions and indoor air quality are key factors in the RSF achieving LEED platinum status.

Through thoughtful design strategies and by focusing on all scales of the building and its processes, the Research Support Facility is on track to meet the aggressive energy goals set forth during project conception. If so, the building will enter into a new category that aims to enhance, rather than simply sustain, the built environment.

Owner
National Renewable Energy Laboratory, Golden, Colo.

Architect
RNL, Denver

Structural Engineer
KL&A, Golden, Colo. (AISC Member)

Steel Fabricator
Paxton & Vierling Steel Company, Carter Lake, Iowa (AISC Member)

Steel Erector
LPR Construction Company, Loveland, Colo. (AISC and SEAA Member)

General Contractor
Haselden Construction LLC, Centennial, Colo.

Structural Software
RAM, ETABS, SDS/2, Revit

National Award—$15 Million to $75 Million

HYPAR PAVILION AT LINCOLN CENTER, NEW YORK

Lincoln Center for the Performing Arts is one of the largest and best-known arts complexes in the world, with 12 independent companies and 15 venues bringing a wide range of events to five million visitors per year. Over the past decade, the center has undertaken an ambitious modernization of its midcentury campus. The central design challenge: reactivating the connection between the 16-acre campus and its Manhattan neighborhood, increasing the visibility of resident organizations and drawing in new audiences.

One of the key architectural solutions to emerge from the modernization project is the new restaurant pavilion. Topped by a striking warped green roof and housing a glass-walled restaurant, the pavilion is a distinctive yet accessible urban form that fulfills complex programmatic requirements while maintaining much-needed public space on the campus.

In addition to creating an iconic shape that stands out among its rectilinear neighbors, the pavilion's unique geometry addresses a number of practical concerns. The lowest point of the structure brings the roof flush with the plaza, extending a friendly invitation onto the grass to both Lincoln Center patrons and casual passersby. The twisting planes tilt the 7,200-sq.-ft lawn away from 65th Street, reducing visitors' exposure to noise and traffic.

The open, serene atmosphere is carried into the 11,000-sq.-ft restaurant, called Lincoln, which features an exposed central kitchen flanked by four public dining areas. Glass walls and a contoured mahogany ceiling frame views to the outside and draw the public's gaze inward. Accessible from both plaza and street level, Lincoln has been praised as one of the nation's best new restaurants since its September 2010 launch.

The simple, streamlined form of the pavilion gives no indication of the complex, densely packed facilities beneath. In addition to three new subterranean Lincoln Center Film Society theaters, the restaurant sits atop the central utility plant, which provides chilled water and steam to the entire campus.

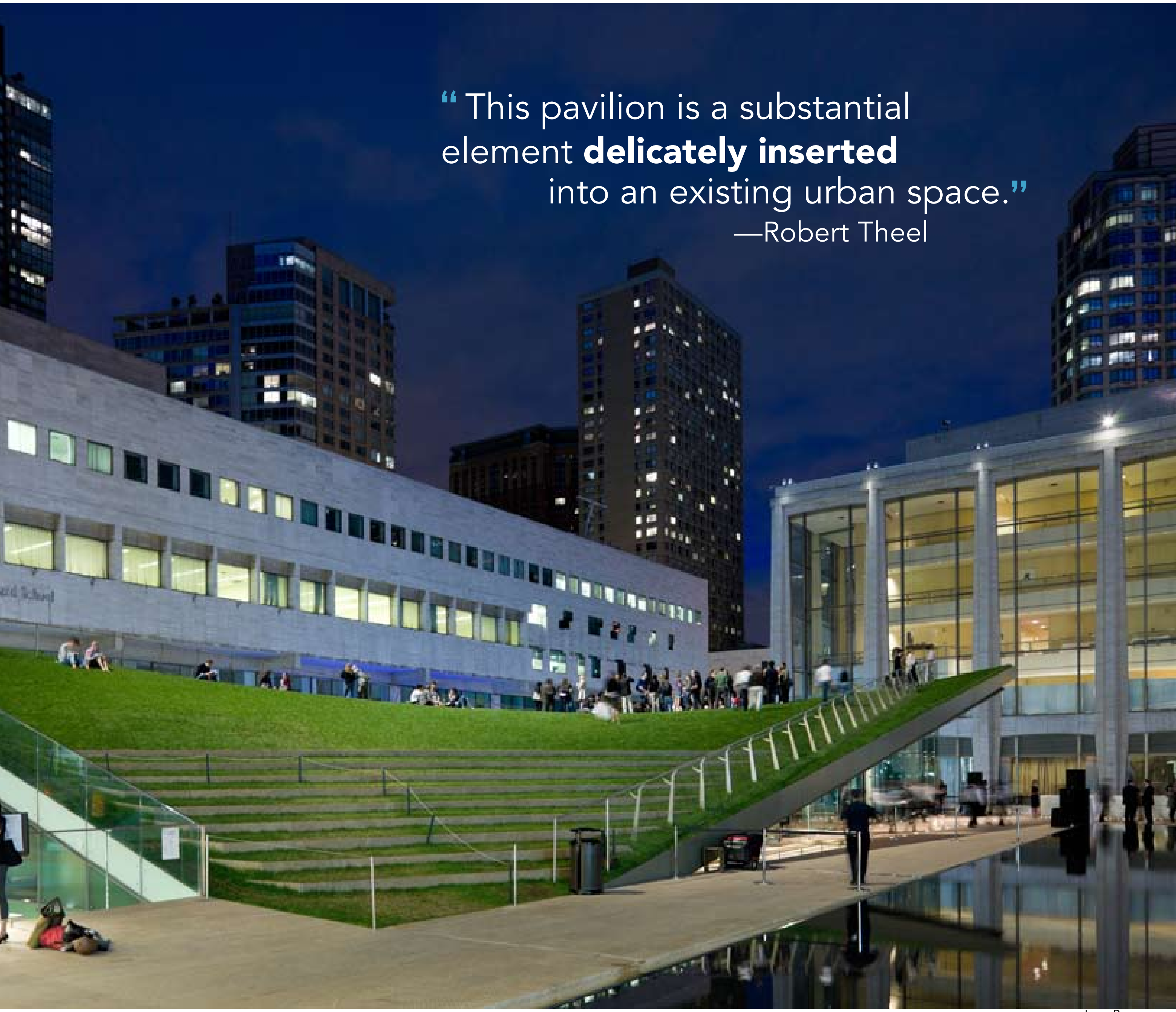
Arup has been engaged at Lincoln Center for more than 10 years, providing structural, mechanical, electrical, plumbing, fire protection and fire engineering services for the full range of modernization projects. Serving as subconsultant for the lawn, restaurant and film center spaces (and as prime consultant for the renovation, expansion and upgrade of the central mechanical plant), Arup used modeling technologies to craft highly tailored, multidisciplinary engineering solutions suited to the complexity of the program.

The layout for the geometry of the pavilion's steel superstructure follows the mathematical principles and main generating lines of a rectilinear hypar. As a result, straight steel members were able to be used for all floor beams. Thoughtful rationalization of the architectural form and use of steel for the primary structure simplified fabrication and enabled rapid construction. The latter was particularly important due to Lincoln Center's need to remain open throughout the design and construction process. The design team and contractors exchanged 3D models, further easing fabrication and aiding interdisciplinary coordination.

Arup's structural design thoughtfully addresses the requirements of each programmatic element. Metal decking with concrete

Iwan Baan

Gordon LaPlante/Rockwell Group



Iwan Baan

poured on top forms the warped floor structure. Columns at regular intervals transfer vertical loading into the existing building. An additional layer of transfer beams underneath the columns transfers vertical loading around the movie theaters and the central mechanical plant into existing footings. On one end, the lower tip of the hypar sockets into the existing waffle slab of the plaza, allowing the transfer of lateral loading into the existing shear diaphragm. On the opposing side, braced frames transfer horizontal loading into the ground.

Throughout the five-year design and construction period, the project team created and coordinated multiple document packages corresponding to the logistical challenges and sequencing of the work, consistently exercising a high level of oversight to minimize conflicts and mitigate unforeseen field conditions.

The new pavilion and improved facilities will enable Lincoln Center to continue providing world-class performances to local, national and international audiences for decades to come. With its unique space-generating structure, complex interface of new and old, and challenging logistical and scheduling requirements, the pavilion pushed New York City's design and building community to the boundaries of existing construction technologies.

Owner
Lincoln Center for the Performing Arts, New York

Architect
Diller Scofidio + Renfro, New York

Structural Engineer
Arup, New York (AISC Member)

General Contractor
Turner Construction Company, New York (AISC Member)

Structural Software
AutoCad 3D, Revit

RIO ROCA ON THE BRAZOS, PALO PINTO, TEXAS

"**Beautiful** building with simple structure."
—Farro Tofighi

This steel, glass, stone, and wood chapel is situated on a bluff overlooking the Brazos River. It was constructed to provide a spiritual retreat for visitors, and a private venue for religious services, performances, and weddings. A flagstone walkway connects the chapel forecourt to a conference, living building higher on the bluff. The chapel seats 50 people in built-in pews.

The steep slope of the site is cut into by a 10-ft-tall stone wall visitors must pass through to reach the chapel. This retaining wall continues through the chapel and supports each steel column to the north. The southern wall is floor-to-ceiling glass with steel columns framing the view. The lateral bracing is placed toward the inside of the chapel to maximize the natural light coming in and minimize any obstruction.

The earth drastically slopes away from the chapel exposing it to high winds. Steel HSS columns and cross bracing are concealed in the stone walls to the south to provide extra support. All of the exposed steel is coated with automotive enamel to keep it from weathering.

Each column is composed of a group of steel HSS wrapped in wood trim. The trim provides the connection to the insulated glass. The steel columns are welded to steel flitch beams that support the copper roof. Steel turnbuckles, threaded rods, and acorn nuts provide a delicate structural system so as not to detract from the chapel surroundings and are connected to the flitch beams and columns to resist spread. The majority of the steel was fabricated in a sheltered environment off site. It was predrilled and painted to assist in the ease of construction. Because all the steel was shop built, the architects also were able to use a known fabricator from previous projects instead of trying to identify a skilled local craftsman in a remote location.

Once on the site, the column and rafter system was erected and bolted into the anchor bolts cast into the foundation. The turnbuckle and tension bar system was assembled and aligned without any on-site welding. The steel in the chapel provides a strong and delicate structure in juxtaposition to the heavy masonry base.

Custom-designed and fabricated steel elements are used throughout the site. An observation deck surrounded by a steel and glass rail overlooks the river. A 20-ft-tall steel sculpture beckons visitors to the chapel at the top of the bluff, acting much like an obelisk of a pilgrimage church. Three steel channels pierce the stone retaining walls to carry the water into a stone basin on the other side. Steel lights and lanterns illuminate the structure and the surrounding landscape.

Owner
Rio Roca Ranch, Palo Pinto County, Texas

Architect
Maurice Jennings + Walter Jennings Architects, PLLC, Fayetteville, Ark.

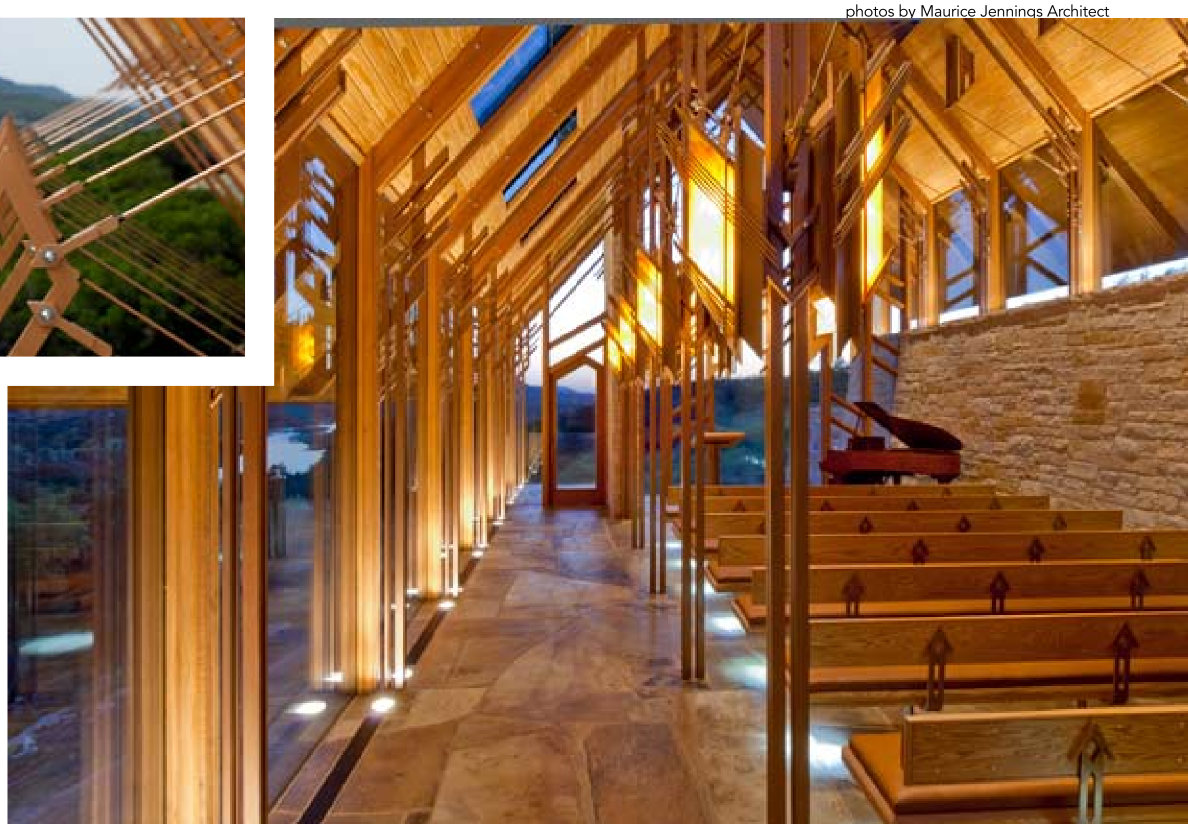
Architect of Record
Maurice Jennings Architect, Fayetteville, Ark.

Structural Engineer
Myers-Beatty Engineering, PLLC, Van Buren, Ark.

General Contractor
English Heritage Homes of Texas, Dallas

Structural Software
RISA-3D, Revit

photos by Maurice Jennings Architect



"An outstanding example of leveraging **LEED design elements** with architecture."
—Kent Long

Photos: James West

National Award—Less than $15 Million

BUCKNER COMPANIES HOME OFFICE, GRAHAM, N.C.

The new headquarters building for a nationwide crane leasing and steel erection company was a long-contemplated update to a venerable, family-run enterprise. Business was good and growing, but market conditions demanded better teamwork and communication. Existing space was cramped and poorly arranged. Most important to the third generation of family leadership, the company's existing offices said nothing of the firm's work, capability, or success.

The Buckner Companies turned its need into opportunity—a chance to project itself as a dynamic and resourceful contracting partner. The firm's new open, airy headquarters in central North Carolina is a showcase for the steel erector's trade. It also tells the story of steel, beginning with the material's salvage and reuse, to its integration with other building systems, and ending with its powerful impact when simply expressed and carefully detailed.

To make a place that would clearly express the company's line of work, Buckner turned to its own crane-rigging yard, which was piled with steel building parts rescued from various construction sites over several decades. Company president Doug Williams provided an inventory of materials from this "boneyard," challenging the design and construction team to incorporate all they could in the new building.

Engineers combed the list and assessed hundreds of steel sections and fabrications for condition, strength and suitability. They found wide-flange members for columns and composite floor and roof beams, cellular beams for floor girders, and open-web steel joists for lightweight spans. Corrugated metal decking found second life supporting the roof and floor, and two sections of 15-ft-tall plate girders became the walls of a new conference room, cantilevered out the front of the building to shelter the main entrance.

Buckner rescued a 15-ton, 58-ft-long pedestrian bridge from the college campus where the company had first installed it 30 years before. The bridge and its pylons became the connector between the new building and the existing offices. Even old crane parts and pieces of rigging found their way into the project, as stair hangers, column braces, and furniture pedestals.

In all, 83 tons of steel—more than 40% of all the steel in the building—came directly from Buckner's yard. This direct reuse eliminated the energy costs normally involved in refabricating salvaged steel, going, in effect, "beyond green" in making use of a material already widely appreciated for having high recycled content.

Virtually all of the structural steel in Buckner's headquarters is left exposed, yet steel is not the only or even the most distinctive structural element in the project. Overhead are pairs of 8-in. by 30-in. curved wood glue-laminated beams—also salvaged—that create the building's roofs and south-facing clerestory. Integrating the steel structure with these wood members was a special challenge for the designers and constructors. From the beginning, the architects, engineers, contractor, fabricator and erector collaborated closely to determine how the

connection between wood and steel would be expressed.

Custom-fabricated steel extensions, or "tails," at the ends of the wood beams served two purposes: to provide the additional length needed to span the building's central space, and to achieve the moment-resisting connections that allowed the wood and steel to work together.

In another carefully considered move, the wood beams pass through slots cut into the webs of an interior line of W14 columns, like thread through the eye of a needle. This interaction has the effect of showing off the ability of the steel to accommodate less malleable structural members.

Despite the challenges inherent in the assembly of the building's many exposed connections, the steel erector, who happened in this case to be project owner, credited the close collaboration on the team with producing a project that was "very erector friendly."

Because most of the building structure was to be left exposed to visually tell the story of the owner's business, detailing and construction quality was a significant focus of the project. The team considered following AESS criteria but rejected that approach, largely because of the desire to repurpose as much salvaged material as possible. Instead, the team placed rigorous emphasis on planning and detail to achieve high aesthetic results. Close coordination among the designers, contractor, fabricator and erector took into account the spacing of framing, types of connections, bolt patterns, and even the orientation of cotter pins.

The new building took form around the notion of surrounding a double height space with the offices of project managers and administrative staff, creating vertical, visual connection among all employees. The project added 15,000 sq. ft to Buckner's existing office building, which was extensively refurbished to make a cafe, exercise area and other high-profile common spaces. These shared places, and the second-level enclosed pedestrian bridge linking the new building with the old, are key to making all employees feel a connection to the new construction.

Fueled by the realized possibilities for reusing existing materials, the Buckner project grew to embrace an all-points sustainable building effort. Green building practices incorporated into the project include a chip-and-tar drive, stormwater bioretention pond, new materials with high recycled content such as galvalume roofing and linoleum floor covering, and water conservation measures including low-flow toilet fixtures and roof drains supplying a 15,000-gallon cistern for vehicle washing. The 15,000-sq.-ft project was completed in May 2010.

Owner
The Buckner Companies, Graham, N.C. (AISC Member)

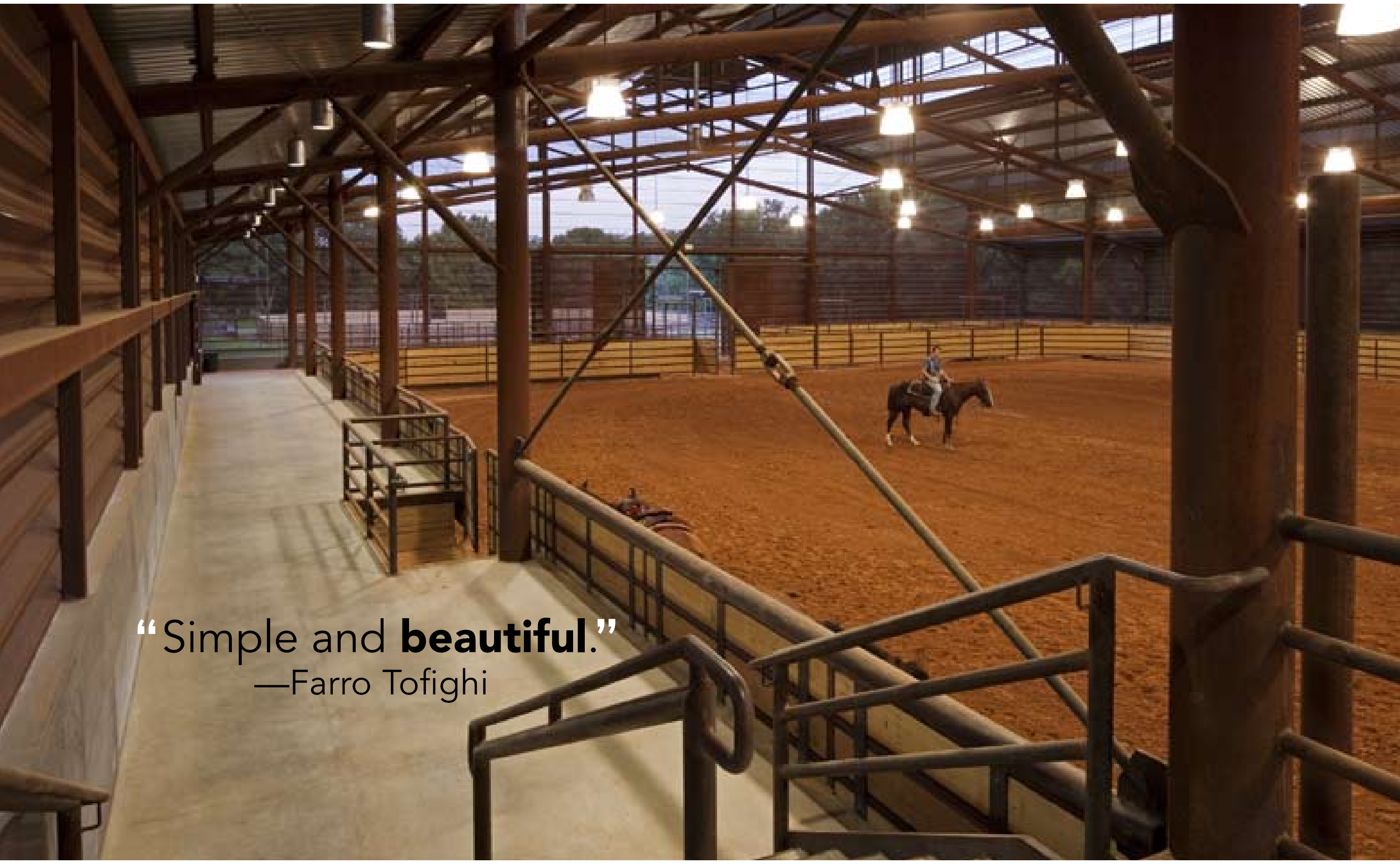
Architect
Weinstein Friedlein Architects, Carrboro, N.C.

Engineer
Stewart Engineering, Raleigh, N.C.

Steel Detailer and Fabricator
CMC South Carolina Steel, Greenville, S.C. (AISC Member)

Steel Erector
Buckner Steel, Graham, N.C. (AISC and SEAA Member)

Contractor
Romeo Guest, Durham, N.C.



"Simple and **beautiful**."
—Farro Tofighi

National Award—Less than $15 Million

CUTTING HORSE RANCH, NORTH TEXAS

This 175-acre ranch in the cross timbers region of Texas was created for the care, training and breeding of cutting horses. The master plan includes a steel-framed arena, horse barns, cattle pens and service structures placed among woods, pastures, roads and trails.

The structural engineer and steel fabricator were early members of the design team that developed the structural and aesthetic vocabulary for approximately 100,000 sq ft of exposed steel structure. The exposed steel columns and trusses express the regional barn vernacular while offering clean, modern lines to the ranch buildings; the perforated, corrugated metal cladding opens the spaces to daylight and breezes, eliminating the need for operable windows. These elements come together to provide a comfortable environment for the horses and staff. The few air-conditioned spaces are clad in galvanized metal and wood, allowing a continuity of design vocabulary and refuge from the hot Texas summer for the ranch hands and managers.

The long structures of the barns and arena sit along a tree-lined creek to block the north wind while taking advantage of summer breezes from the south. The arena cuts into the sloping grade to reduce the impact of this tall structure. Repeating gable roof forms, supported by steel pipe trusses, continue from the arena to the training barn and provide cover for a connecting ramp, horse walker, and wood-clad ranch office. The covered ramp continues

photos by Frank Ooms Photography

alongside a long water trough to the outdoor arena and gathering pavilion. Isolated against the tree line to the west is the mare barn while the tall hydrotherapy barn fills the space between barns and arena.

The pastures are defined by a five-rail pipe fences with steel-framed loafing sheds placed throughout for sheltering horses, while selective clearing left stands of mature trees for shade. The loafing sheds, made of oxidized steel and weathered wood, sit in the grassy landscape of the pastures.

Classic barn shapes surrounded by rolling fenced pastures provide a familiar quality to a project with a modernist application and detailing of structural and clad steel.

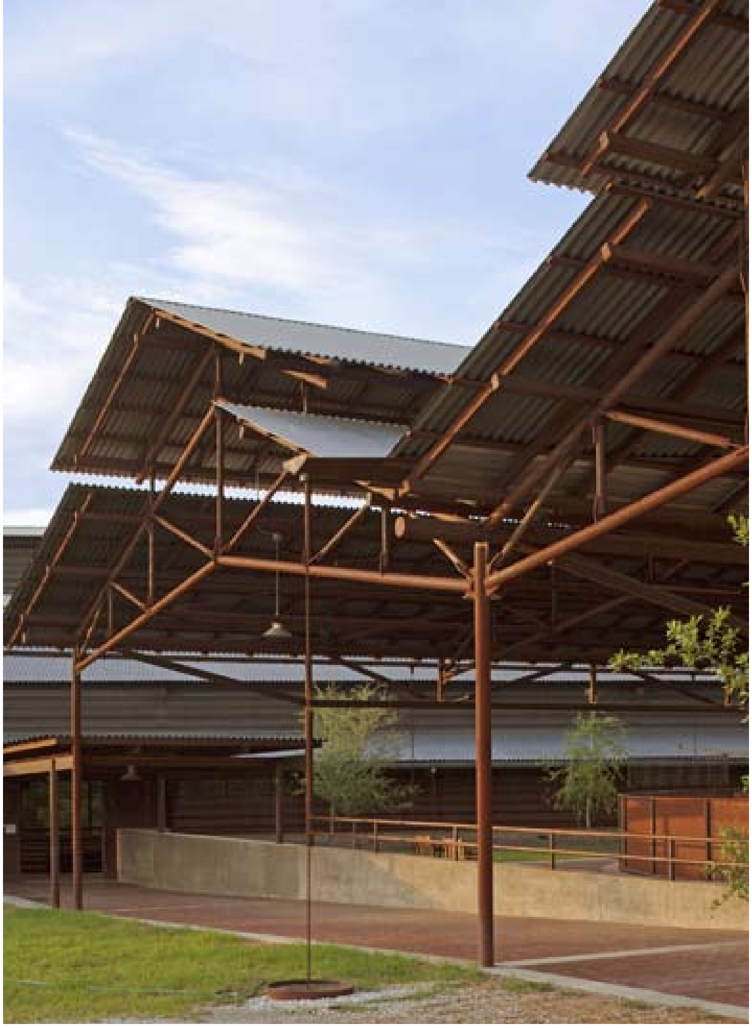
Architect
Lake|Flato Architects, San Antonio, Texas

Structural Engineer
Datum Engineers, Austin, Texas (AISC Member)

Steel Erector
CN Construction, Inc., Fort Worth, Texas (IMPACT and SEAA Member)

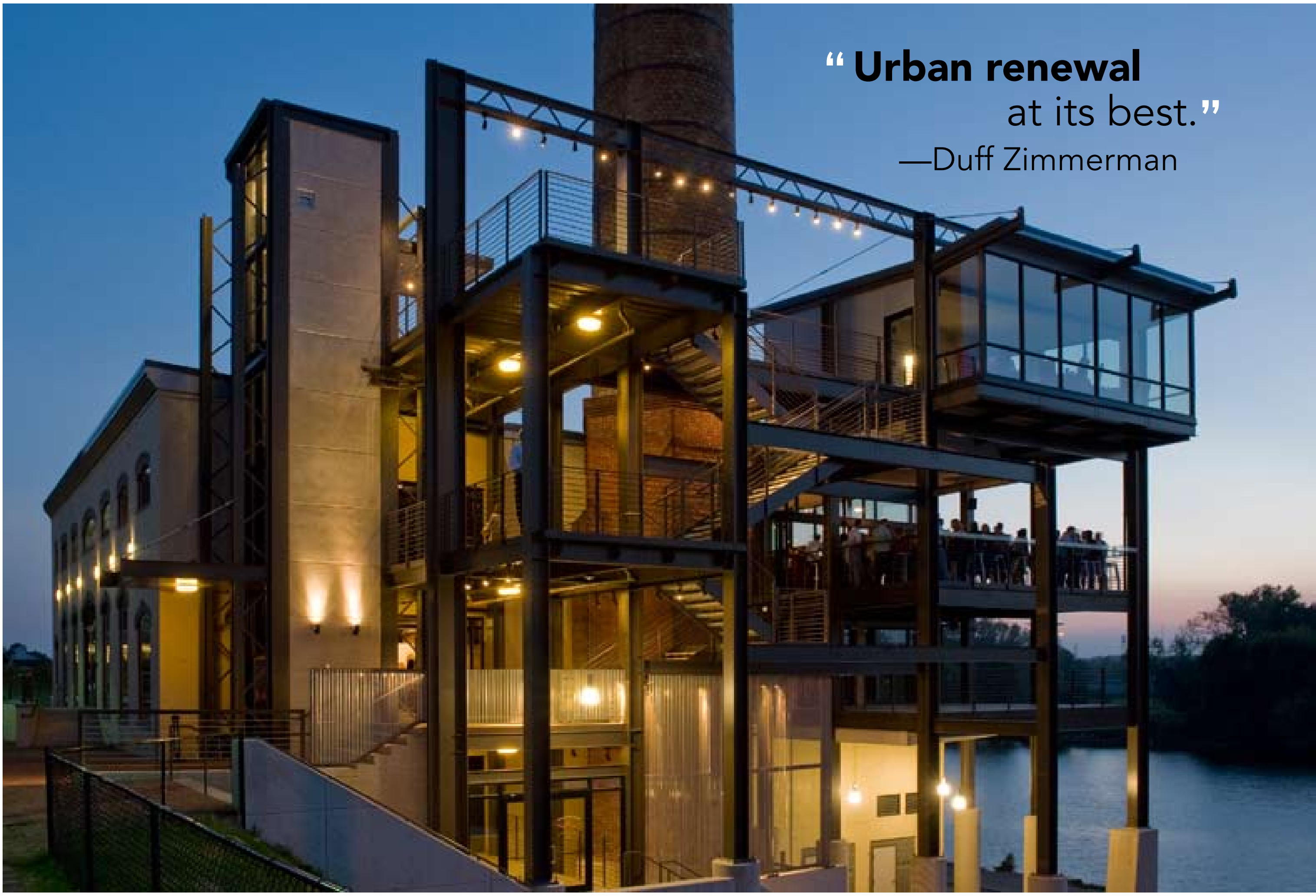
General Contractor
Lincoln Builders of Texas, Fort Worth, Texas

Structural Software
RISA-3D, RISA-2D, Revit



Merit Award—Less than $15 Million

THE POWER PLANT AT ROCKETTS LANDING, RICHMOND, VA.



"Urban renewal at its best."
—Duff Zimmerman

The Power Plant at Rocketts Landing, constructed in the late 19th century, was once the primary power supply for the industrial city's fleet of trolleys. As train transportation became increasingly obsolete, so did the need for this once-booming plant. When private developers made plans for a new residential and business neighborhood, the design team was charged with preserving and repurposing the plant. Beautifully situated along the historic James River, the goal was to maximize connectivity between the plant's indoor and outdoor spaces with the nearby waterfront while maintaining its historic integrity street side.

Through the use of structural steel, the design team was able to innovatively transition the 27,000-sq.-ft mixed use facility. Embracing the industrial aesthetic of the Power Plant, the team incorporated a steel frame skeleton to overlap the building's existing structure, merging antiquity and modernity. Approaching from the west, a soaring, industrial smokestack emerges from a new skeletal structure of steel and glass. The stack is a reminder of the building's legacy, while the modernistic steel structure communicates a renewed sophistication for the revived waterfront district.

The adaptive reuse integrates a five-story indoor and outdoor piazza that begins at the flood plain level and rises to the roof. The first and second levels are utilitarian spaces, assumed by the Virginia Boat Club for the storage of crew hulls. The Boathouse Restaurant occupies a 12,000-sq.-ft space on the third and fourth floors. The waterfront dining areas and outdoor decks offer 180° views of the James River and the Richmond skyline.

The plant's stairs and mezzanines are constructed of exposed steel that accentuates the industrial aesthetic, while providing efficient access to the main facility. Structural steel provided the lateral bracing through the use of rods and moment connections to accommodate the code-required loading as well as bracing to prevent uncomfortable movements perceptible to the occupants.

In keeping with the original industrial use of the building, the new stair and elevator tower features the use of exposed W12×35 wide-flange columns on the street side that have been built up with a vertical open-web joist. Double 6×3½×½ steel angles form the chord attached to the W12 while the opposite chord consists of the same size double angles attached to photos by Eric Taylor Photography

the back of a C10×30. The diagonal web members are ½-in. steel plate 2 in. wide. The canopy at this entrance features steel members cantilevered from the building façade supported at the free ends by a #3 clevis and 1-in.-diameter rods.

The interior spaces were renovated using structural steel to reinforce the existing structure as well as provide a new roof structure for the dining room and kitchen. The building roof was designed to accommodate the desire for an exposed structure and large storefront enclosure to provide natural daylighting and dramatic views of the river. Crowning the building is a glass and steel pavilion topped with a butterfly roof angling upward for a clear, multi-dimensional view of the water. Exposed steel includes a custom built-up truss consisting of double 6×3½×½ top and bottom chords with 2-in.-wide, ½-in.-thick steel plate diagonal web members.

The new design elements also accommodate natural daylighting, including an enhanced view of the surrounding waterfront. The new plant is crowned with a glass and steel pavilion, featuring a butterfly-angled roof.

The new plant design utilizes a combination of RISA-3D for the structural analysis and REVIT for the architectural models, providing a more accurate visualization of the structure for both the project owners and the design team. These models were invaluable for detailing and coordinating fabrication and later during erection of the steel elements.

Because this renovation is part of a larger brownfield redevelopment, the fact that its design played a significant role in reducing waste and promoting sustainability during the redevelopment and redesign of the facility was significant.

The newly repurposed plant honors the timeless beauty of the past infrastructure, while encouraging future growth and innovation through the use of modern technology and design. Enhanced with structural steel, the newly repurposed $3.5 million Power Plant incorporates a modern-industrial edge while honoring the storied past of this historically significant building.

Owner
The WVS Companies, Richmond, Va.

Architect
H&A Architects & Engineers, Virginia Beach, Va.

Structural Engineer
Draper Aden Associates, Richmond, Va. (AISC Member)

Steel Joist Manufacturer
Vulcraft, Florence, S.C. (AISC Member)

General Contractor
KBS, Inc., Richmond, Va.

Structural Software
RISA-3D

Merit Award—Less than $15 Million

MONTECITO RESIDENCE, MONTECITO, CALIF.

Located in the hills above Montecito, Calif., the residence was designed to take advantage of the site's prominent features, including majestic oak trees and large boulders. The house is divided into two wings. A public wing includes living, dining and kitchen areas and opens up to the main outdoor dining and lounging areas. The second, more intimate wing contains bedrooms, bathrooms and a library, all of which open up to small outdoor courtyards and terraces. The property also includes a lap pool and an existing guest house.

The most striking feature of the house is its expression of exposed structural steel frames and insulated metal panels. Continuing the architect's ongoing steel residential design investigation, initiated in the 1970s, the Montecito Residence is the fourth completed iteration in an ongoing research project that has been tested for the past seven years in a design research studio in a renowned Los Angeles-based school of architecture. The intention behind the design strategy is tectonic design research that creatively envisions a flexible prototype for mass-produced housing using steel construction and standardized off-the-shelf industrial components.

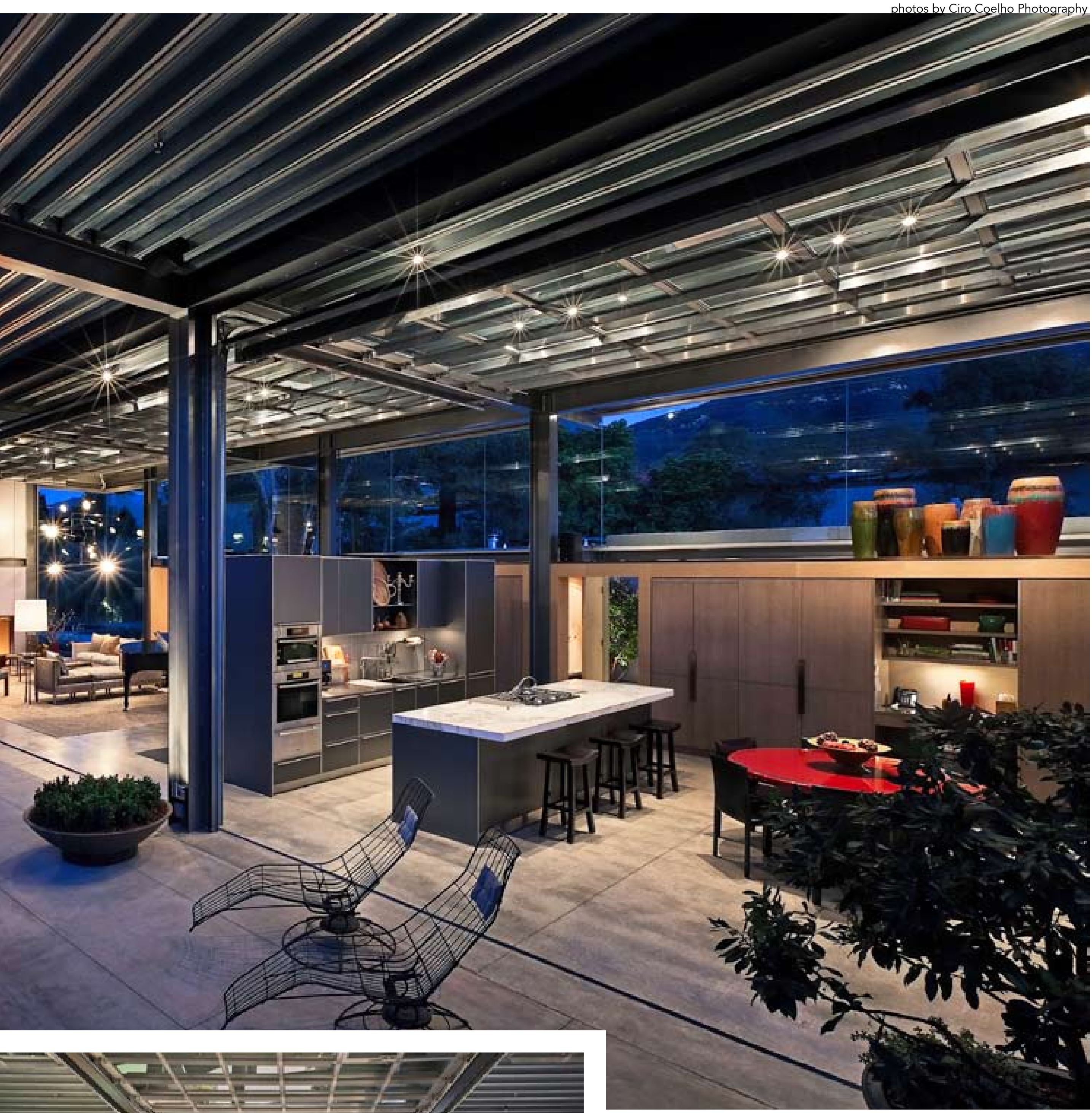
Because structural steel is manufactured primarily from scrap metal it is inherently a "green" material. After being fabricated offsite, the steel frame can be rapidly erected and does not generate the typical amount of construction waste caused by wood frame construction. The design advances concepts of adaptive space while creating a "kit of parts" that can be assembled into 20-ft modules as an alternative to the manufactured buildings mitigating the unpredictable link of manufactured units to serviced land.

Contrary to most steel-framed buildings—where the steel is ultimately concealed from view—this building was designed so all its steel connections are exposed and visible in the final product. Great care was required from the entire team, including architect, structural engineer and the fabricators who carefully crafted a final product. The steel wide-flange columns were designed by the structural engineer as cantilevered posts, fixed below grade by concrete grade beams in two directions, allowing the exposed connections between columns and beams to be elegantly welded as moment frames.

One of the clients' desires was that their residence would be designed to take full advantage of the indoor-outdoor living made possible by the California coast's mild climate. Structural steel is particularly well suited to allow for a maximum amount of glazed openings, from large expanses of fixed glass to operable glazed "garage" doors and sliding doors. Another important factor in choosing materials for this residence, located in a fire-prone area, is steel's inherent non-combustible nature.

Designed specifically without air-conditioning, the house is cooled by cross-ventilation. Large operable sectional glass doors, sliding doors and windows can be opened and closed to quickly adjust to the climate conditions and the occupants' comfort. In addition, the house's radiant heating system is fed by solar collector panels. Other sustainable features include highly efficient boilers, photovoltaic panels and an Energy-Star rated "cool" roof.

photos by Ciro Coelho Photography



Owner
John and Dorothy Gardner, Montecito, Calif.

Architect
Barton Myers Associates, Inc., Los Angeles

Structural Engineer
Norman J. Epstein Structural Engineers, Los Angeles

Steel Detailer, Fabricator and Erector
Anvil Steel Corporation, Gardena, Calif. (AISC Member)

General Contractor
Caputo Construction Corp., Los Angeles

Merit Award—Less than $15 Million

HOUSE OF AIR, PRESIDIO BUILDING 926, SAN FRANCISCO

In 2010 two young entrepreneurs with an interest in action sports opened House of Air, a trampoline facility that caters to the young, energetic population of active San Francisco. The single-story, steel-framed building is a historic aircraft hangar located at the western end of Crissy Field and the foot of the Golden Gate Bridge within The Presidio of San Francisco, a national park.

The facility includes more than 6,500 sq. ft of conjoined trampolines. A large field trampoline for bouncing sits alongside a trampoline dodge ball court and three performance trampolines used for competitive jumping and ski, snowboard, and wakeboard training. Flanking the trampoline area is 10,000 sq. ft of amenity space including two pavilions housing a café, meeting facilities, lockers, and a lounge. Translucent blue walls lit from within are graphic interpretations of the vertical motion which takes place throughout the facility.

The client's objectives were purely to construct and operate a facility that could accommodate their business plan. The architect's objective was to create a space that would act as a branding device in a visual manner, thus elevating what could otherwise have been a base commercial experience to a level matching the sophisticated site and clientele.

The seismic strengthening of the structure included new ductile steel special moment resisting frames, which are integrated into the existing building with a tension rod roof diaphragm. The strengthening scheme was carefully detailed to minimize the impact on the existing building fabric and allowed many of the building's character-defining features to remain.

The Presidio has stringent requirements for maintaining the history behind its existing buildings. As with most historically significant buildings the way in which they were built tells a story about both construction practices and social and economic circumstances at the time. Maintaining the story associated with this historic biplane hangar was an important driver for the approach taken with the House of Air. Very little of the original building fabric was removed and the inherent strength of the existing structure was used to the greatest extent possible. In addition, the House of Air project is LEED certified with many of the credits coming from the reuse of existing materials.

The renovation and remodeling of the existing historic hangar was no small task. The existing building consists of a steel trussed roof spanning 110 ft. Steel columns support the roof at the perimeter creating a 17,500-sq.-ft column-free floor plate. The existing structure is built on artificial fill prone to liquifaction in a high seismic zone. Adding to that the 3-in.-thick concrete roof structure—bomb-proof by 1920s standards—which had to remain intact, it was clear that the building was in need of strengthening.

Architecturally, the hangar remains a large-volume structure with free-standing elements installed within it. The original roller door was removed and a 45-ft glazed overhead bifold door was constructed at one end of the building. Internally, this large oculus is flanked by structurally independent pavilions housing discreet programmatic elements and clad in translucent blue polycarbonate. Large openings in these walls are fitted with pivoting panels to provide privacy to the interior rooms. An exposed structural steel catwalk connecting the upper floors of the pavilions allows for elevated vantage points from which to observe activity on the trampolines below.

Providing a cost-effective and efficient method to strengthen the building and developing details for the new trampolines to accommodate the uneven slab were the two most difficult tasks the design and construction team had to address.

The addition of new special moment-resisting frames (SMRF) to the building was a straightforward solution, but developing a methodology for tying the building together at roof level was challenging. The existing roof includes a 10-ft pop-up clerestory space effectively separating the roof into two halves. These separate roof sections also change in pitch at their midpoint creating out-of-plane reactions at the roof diaphragm. In addition to the geometric constraints, the roof is clad with 3 in. of unreinforced concrete.

The final solution provides isolated strengthening to the existing gravity truss top chords which could then be utilized as compression members in a new roof diaphragm. New diagonal rod bracing, 2 in. in diameter, was installed to complete the diaphragm "truss" while the out-of-plane reactions resulting from the change in roof pitch are resisted by the strengthened gravity trusses. By addressing these two issues in unison, the design team was able to limit the addition of new material to an existing historic building and deliver a diaphragm stiff enough to protect both the existing gravity frames and the brittle concrete roof.

Investigating materials at the outset of the project showed that the original steel was suitable for welding, which facilitated the integration of the new lateral bracing and gravity strengthening, one of many advantages of using structural steel.

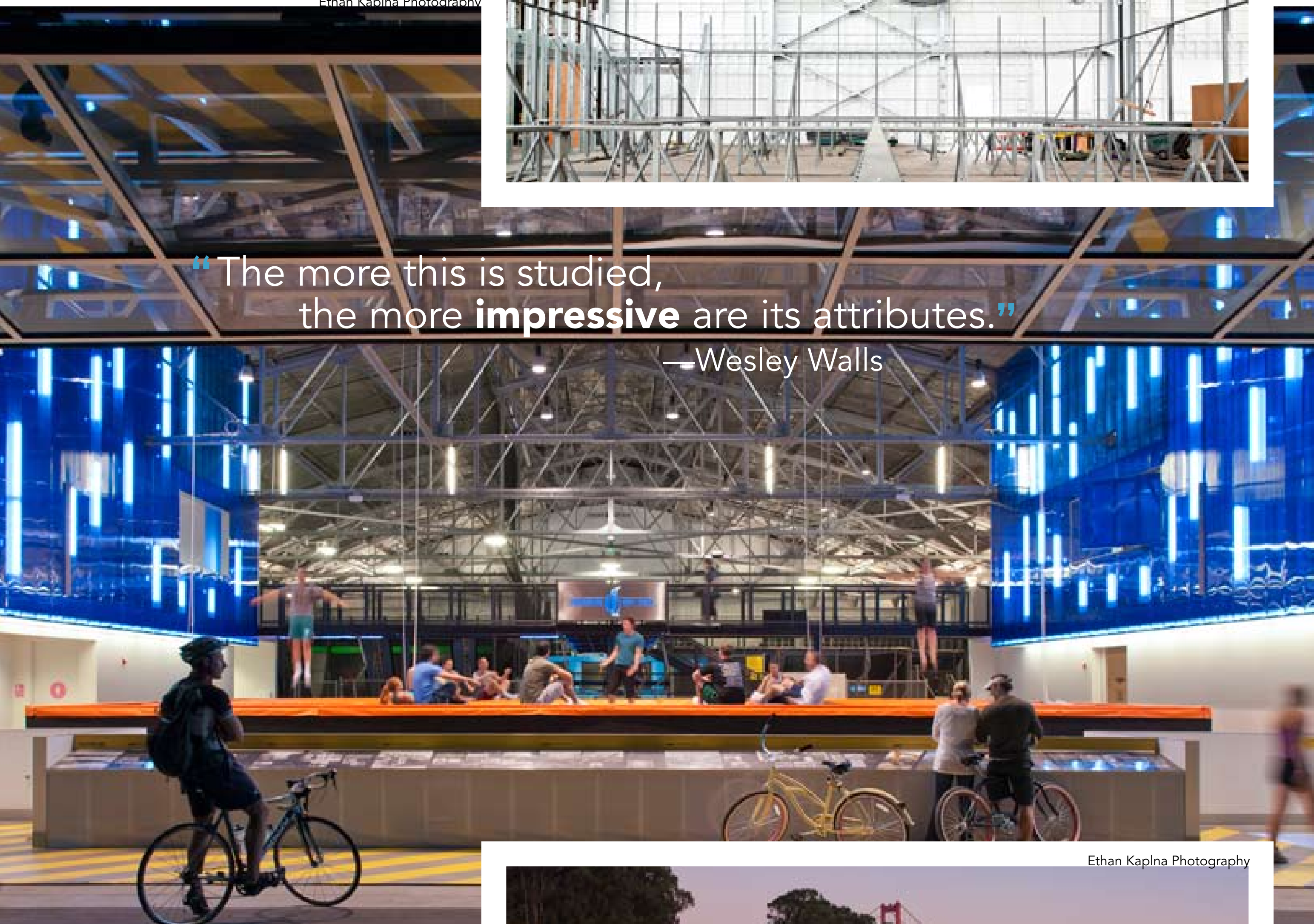
In addition to the base building seismic retrofit and core and shell work, the structural engineer designed a vast network of conjoined trampolines, providing detailing as well as structural calculations and drawings to meet the requirements of the California Building Code.

The design required complex analysis of the individual trampoline framing members. A finite element analysis model was used to capture the various stresses in the members and back checked against static catenary action spreadsheets. The resulting member sizes—HSS $3\times1\frac{1}{2}$ with wall thicknesses from $\frac{3}{16}$ in. to 14 gauge—were strong enough to demonstrate compliance with a wide range of impact loads while still being easy to fabricate. The trampolines were modeled in Revit to simplify the fabrication and installation process. That proved to be especially helpful with the complex geometry in the dodgeball court and double bowl.

The trampoline framing uses more than 6,500 ft of HSS. A system of adjustable legs detailed to accommodate more than 5 in. of undulation in the existing hangar slab. That permitted fabricating all trampoline legs the same length while at the same time allowing the trampoline beds to be perfectly level. By using a section of threaded rod and locking nuts for each leg, its overall length could be shortened or extended to suit its location by simply spinning the base plate, saving a significant amount of time during the 350-leg installation.

Blake Marvin

Ethan Kaplna Photography



“The more this is studied, the more **impressive** are its attributes.”
—Wesley Walls

Ethan Kaplna Photography

Ethan Kaplna Photography

Owner
House of Air, San Francisco

Architect
Mark Horton Architecture, San Francisco

Structural Engineer
Holmes Culley, San Francisco (AISC Member)

General Contractor
Hathaway Dinwiddie Construction Co., San Francisco

Structural Software
RISA-3D

Merit Award—Less than $15 Million

LADY BIRD LAKE HIKE AND BIKE TRAIL RESTROOM, AUSTIN, TEXAS

The Lady Bird Lake Hike and Bike Trail is a linear park of scenic trails and landscaping that follows the banks of the Colorado River in downtown Austin, Texas. Very popular among runners and bike riders, the park provides residents and visitors with a rural escape in an urban setting. The Restroom—the first public restroom built in the park in more than 30 years—was built by the Town Lake Trail Foundation, a community-based non-profit organization, in partnership with Austin's Parks and Recreation Department.

The Restroom was conceived as a sculpture in a park, a dynamic object along the active trails. The structure consists of 49 vertical ASTM A588 weathering steel plates, each ¾ in. thick. The width and height vary significantly, from 1 ft wide by 1 ft, 6 in. tall to 2 ft wide by 13 ft tall. The panels are arranged along a spine that coils at one end to form the restroom walls. The plates are staggered in plan to control views and to allow for the penetration of light and fresh air. Both the door and roof were fabricated from ¾-in.-thick steel plates as well.

The restroom is handicapped accessible and includes a drinking fountain and shower outside in addition to a commode, urinal, sink and bench inside. The simple building requires minimal maintenance: the plumbing fixtures are made of heavy-duty stainless steel, there is no need for artificial light or mechanical ventilation inside, and the steel panels will weather naturally over time.

Owner
The Trail Foundation, Austin, Texas

Architect
Miró Rivera Architects, Austin, Texas

Structural Engineer
Architectural Engineers Collaborative, Austin, Texas (AISC Member)

General Contractor
The Trail Foundation, Austin, Texas

"Talk about your **innovative design**. This is NOT the trail bathroom you'd expect."
—Jay Schneider

photos by Paul Bardagjy Photography

Presidential Award of Excellence in Engineering

OTTAWA STREET POWER STATION, LANSING, MICH.

Constructed in 1939, the Ottawa Street Power Station along Lansing, Michigan's Grand River was decommissioned in 1992 and sat idle for more than a decade. Its resurrection for use as a national headquarters by Lansing, Mich.-based Accident Fund Insurance Fund of America began in 2007. Converting the abandoned vintage power station into prime office space relied on a detailed erection plan and flawless execution.

Imagine building a 10-story steel-framed office building inside an existing masonry structure, all the while having to both preserve and support the heavy shell. Then add the complication that much of the existing steel had to be removed before the new framing and floors could be installed. These were just some of the challenges facing the project team.

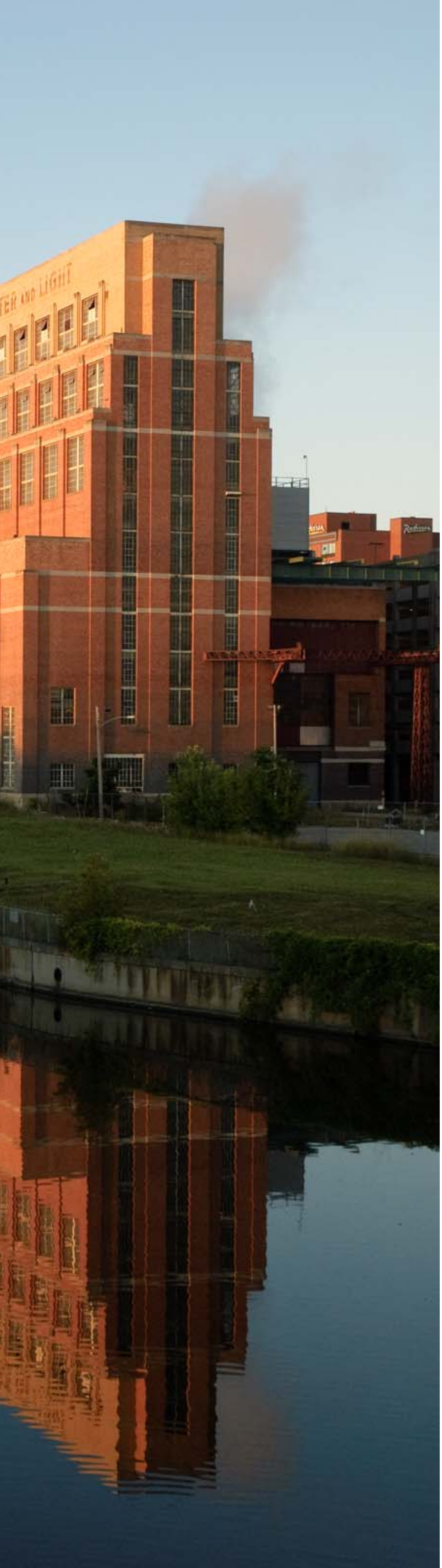
The team's collaborative solution was much like building a ship in a bottle. The construction manager, Christman Company, turned to Douglas Steel and Ruby + Associates to provide design and construction expertise in evaluating design alternatives to convert the power plant into a modern, energy-efficient 10-story office building without disturbing the historical exterior. This team began in the spring of 2008, and completed the main structural steel erection ahead of schedule, even with a late start due to site delays.

The existing building consisted of two primary areas: a 10-story tower and the original turbine hall. Working within the confines of an existing structure posed major access obstacles. Douglas Steel developed an innovative technique that enabled erection of the internal structure without disturbing the building exterior. The process involved installing two temporary 14-ft by 40-ft roof hatches at the top of the 10-story tower, hoisting all of the steel through these roof hatches, and setting the new steel from the ground up. That meant that all steel would be set "in the blind"—the crane operator would not see the piece being lowered into position, nor would he see the ironworker setting the piece. This required a detailed erection plan with a reliable communication system between the ironworkers and the crane operator. To capitalize on this effort, Ruby carefully analyzed the tower structure to maximize "first pass" demolition, giving the trades a safe working environment while minimizing obstruction.

To maneuver the steel in the turbine hall, Douglas Steel took advantage of the existing crane way. The original overhead crane was to remain in the structure as a historic artifact, but it had not been operated for more than 25 years. Douglas' creative solution consisted of installing a new custom overhead crane for the duration of the project which used the existing crane runway and original rails. In the turbine hall, new steel for the fourth floor was attached to the original and architecturally exposed crane girders. The third floor steel was then hung from the bottom of the fourth floor steel.

Initially Arup, the structural engineer of record (EOR), used documents from the original 1939 construction of the power plant to create a Revit model of the structure. Engineers then deleted and added members to the model as required.

"Rehabilitating a public landmark is always noble, **always complex**, and this project redefines both."
—Wesley Walls



When the framing design was completed, the EOR provided a CIS/2 version of the model so the fabricator could import it into its SDS/2 modeling software. Douglas and Ruby provided ongoing value engineering suggestions to help minimize fabrication and erection costs, such as changing the 4-in.-diameter rod bracing to HSS sections.

In preparing for fabrication, Douglas Steel used both the historical documents and the building model to locate where each new member attached to either an existing column or member. Each location was laid out on the existing steel, photographed and measured. The fabricator developed a method to use the existing riveted steel end connection as part of the new design. Because of variance in existing column-to-column dimensions, the member could be up to 1 in. longer, which required designing the connection for the maximum eccentricity.

This process of evaluating each connection condition was used for approximately 2,000 beams. The bracing connections were attached to existing columns, which consisted of built-up shapes riveted together. Ruby helped to design these unconventional connections along with complex gravity connections that mated new framing to the original.

Ruby also performed a structural analysis for the renovation using a finite element model, and provided floor-by-floor sequencing, to maximize internal demolition while still achieving stability. Ruby's largest challenge was to balance the systematic removal of the 10-story structure's interior with ever-changing load paths, levels of acceptable stress, and overall lateral deflections on the fragile brick façade.

Through that analysis, Ruby identified which existing steel members had to be retained as reconstruction occurred, and when those members could be "surgically removed" as reconstruction progressed from the ground up. With careful analysis and planning, structural stability was maintained during demolition and reconstruction without the need for additional bracing.

The team carefully coordinated structural steel elements with other materials to preserve the aesthetic and visual impact of the project:

- Exposed interior steel beams and columns demonstrate the original industrial structure.
- Design incorporates the historic structure by leaving exposed historic brick masonry and by holding back the new ceilings from the exterior walls allowing the full height of the windows to be viewed from each floor.
- Original turbine hall overhead crane, rails, structural steel girders, and bearing support points remain as an esthetically exposed feature.

The Ottawa Street Power Station is now registered on the National Park Service's National Register of Historic Places. The project is expecting to be LEED certified. Construction waste management has achieved nearly 100% waste diversion, by weight (7,000 tons), including 800 tons of steel and 600 tons of concrete. About 75% of the building's existing brick and 95% of its existing masonry was cleaned and reused.

Owner
Accident Fund Holdings Inc., Lansing, Mich.

Construction Manager and Developer
The Christman Company, Lansing, Mich.

Architect of Record
HOK, St. Louis

Architect
Quinn Evans Architect, Ann Arbor, Mich.

Structural Engineer of Record
ARUP, Chicago (AISC Member)

Construction Engineer
Ruby + Associates, Inc., Farmington Hills, Mich. (AISC Member)

Steel Detailer, Fabricator, and Erector
Douglas Steel Fabricating Corporation, Lansing, Mich.
(AISC and IMPACT Member)

Structural Software
SDS/2, RAM, RISA-3D, SAP2000, Revit Structure