IDEAS² awards

Innovative Design in Engineering and Architecture with Structural Steel

THE DESIGN AND CONSTRUCTION INDUSTRY recognizes the importance of teamwork, coordination and collaboration in fostering successful construction projects today more than ever before. In support of this trend, AISC 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, 2009 and December 31, 2011;
- Projects must be located in North America;
- Previous AISC IDEAS² or EAE award-winning projects were not eligible.

2012 IDEAS² Awards Jury

- **Edward "Ted" Hazledine** is the founder and CEO of Benchmark Fabricated Steel, a Terre Haute, Ind.-based AISC Certified Fabricator that has been in business for more than 40 years, serving the construction industry in more than 25 states and several foreign countries. The company provides design-build and design-assist services focusing on contructability, team building and collaborative construction. Hazledine has served with civic and trade associations in various capacities and is currently a member of the AISC Research Committee. A graduate of Purdue's Krannert School of Management, he enjoys interacting with engineering and construction management students at Purdue, Rose-Hulman Institute of Technology and Indiana State University. He recently presented on the importance and impact of the fabricator-detailer relationship in working with BIM and 3D software at the 2012 NASCC: The Steel Conference.
- **Alford "Andy" Johnson** spent more than 20 years as a sales engineer and regional manager with the construction division of ARMCO Steel Corporation, working both domestically and in Europe. He was the vice president of marketing for AISC from 1990 to 2004, where he created and directed a national team of structural engineers for technical marketing and sales; directed the creation of an ongoing market research program, leading to focused marketing efforts for the entire industry; directed the creation of AISC's Steel Solutions Center; and created the design award competitions that eventually became the IDEAS² Awards. He is currently board president for the Taos Center for the Arts, a not-for-profit organization supporting the visual and performing arts in Taos, N.M.
- **Daniel Labriola**, a project manager with Pepper Construction Company in Tinley Park, Ill., began his career in construction in 1997, specializing in design-build. He joined Pepper in 2000 as a project engineer. He is responsible for the budget and schedule and provides construction management from the preconstruction phase through turnover. He has an ASHE Healthcare Construction Certificate and is a Certified Healthcare Constructor.
- **Eric Liobis** is an honors student currently in his senior year at Rose-Hulman Institute of Technology in Terre Haute, Ind. and will be completing a double major in Civil Engineering and Mathematics. His studies have focused on structural analysis and design. In 2009-10 he received the Rose-Hulman Civil Engineering Department's Faculty Award and was named a Heminway Scholar. Liobis has been active in numerous engineering projects at Rose-Hulman, including managing the school's 2011 and 2012 entries in the Great Lakes Regional Conference concrete canoe competition, designing a LEED-certified pedestrian park in Terre Haute and designing an art gallery in conjunction with an architect from Ball State University. This past summer Liobis interned with Tutor-Perini Corporation, working on a $93 million renovation project of the Newark Bay Bridge on the New Jersey Turnpike. He is currently planning on pursuing a graduate education to eventually obtain a Ph.D.

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; sustainability considerations; 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 and architecture. This year's winners range from an S-shaped pedestrian bridge to a campus commons area that doubles as a winter garden to a steel-framed "tiara" on top of a skyscraper.

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

2012 IDEAS² Awards jury, from left: Andy Johnson, Ted Hazledine, Eric Liobis, Wayne Perlenfein, Asma Momin, Daniel Labriola, Todd Rich, Osbourne K. Sims, III.

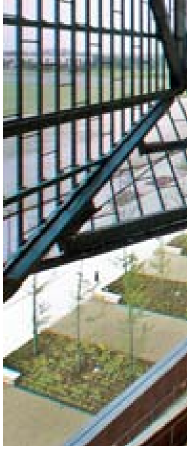
- **Asma Momin**, P.E., is a structural engineer in the Dallas office of PageSoutherlandPage, an international, 425-person A/E firm founded in 1898. With over a decade of experience in multiple building types, Momin works closely with clients to develop structural solutions for healthcare, commercial, academic, retail and civic projects, including buildings located in seismic zones and high-wind regions. She has produced construction documents and details for cost estimates, presentation drawings and narratives that comply with both Department of Defense and General Services Administration progressive collapse and blast requirements. Her extensive experience with healthcare projects includes retrofitting medical equipment such as linear accelerators, CT scanners and MRIs in existing structures. She is currently leading two major projects for the U.S. Department of Veterans Affairs: an Outpatient Clinic in Austin and the Long-Term Spinal Cord Injury Facility in Dallas. Momin, who joined PageSoutherlandPage in 2006, is active in several industry and professional organizations, including AISC, SEAoT and the World Affairs Council of Dallas/Fort Worth.

- **Wayne Perlenfein**, AIA, leads federal market strategies in Perkins+Will's Washington, D.C. office. He is a registered architect with 37 years of experience in planning/programming, design, construction and facilities stewardship within the private sector and public government. He is experienced in all aspects of program and project management, planning, design and execution of design-build and design-bid-build of classified and unclassified projects. Perlenfein manages in-house and consultant project managers, architects, engineers, planners, programmers, construction managers, contract specialists and professional support staff. He also participates in government-focused industry advisory councils and in the development of agency-wide national design prototypes.

- **Todd Rich** is the manager of Web and Graphic Systems with the Design-Build Institute of America, Washington, D.C., as well as a contributing editor to *Integration Quarterly*. A member of the DBIA staff since 1997, Rich is currently responsible for the organization's electronic communications and website, as well as writing for its quarterly journal. She also serves as managing editor for *Design-Build Insight*, DBIA's weekly electronic newsletter, and copyeditor for DBIA's print and electronic communications. In the past, Rich was responsible for designing DBIA's print communications as well, serving as graphic designer and contributing editor for *Integration Quarterly's* predecessor, *Design-Build Dateline*, and many of DBIA's promotional materials. Before joining DBIA, Rich worked for the American Council for Engineering Companies (ACEC), where she was a graphic designer and webmaster and provided training, documentation and first-stage tech support for the office's systems.

- **Osbourne K. Sims, III,** is the president and CEO of Sims Properties Development and Management, Inc., a total property development group capable of handling projects from inception to completion, whose services include project feasibility studies, financial proformas, financial packaging (public and private), commercial and residential design and construction and property management. Before starting his own firm, Sims was the chief architect and space facilities officer for the U.S. Environmental Protection Agency's Region V.

Terry Wier Photography



National Award—Greater than $75 Million

IRVING CONVENTION CENTER, IRVING, TEXAS

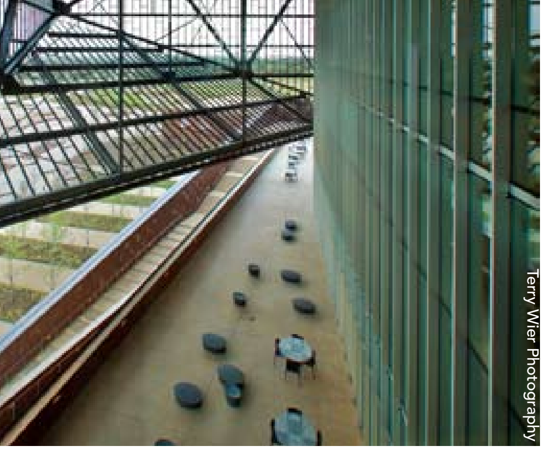
The new Irving Convention Center was conceived to garner attention—but just the right amount. Architect RMJM's stacked design allows the building to act as a landmark visible from many points in the surrounding area, while at the same time minimizes the building's footprint in order to conserve land for other development. The building, located on the northwest corner of a 40-acre tract in the heart of the Las Colinas development in Irving, Texas, is the first of several phases of a new entertainment district.

The stacked design placed the conference rooms and ballroom above the convention center floor. In order to achieve the approximately 190-ft span above the column-free space, structural engineer Datum Gojer used a set of four trusses: three catenary trusses and an arch truss, all approximately 40-ft deep.

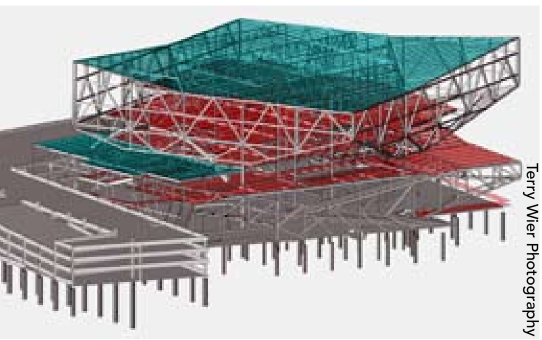
The catenary-style trusses were used to support the majority of the floor and use a catenary bottom chord, in straight segments between work points and extending down from the fourth-floor ballroom level to well within the convention space. The arch truss supports the west end of the elevated floor plates. In addition to architectural limitations that precluded the use of the catenary truss at this location, the arch truss had the added benefit of allowing a clear, diagonal-free space to place egress corridors. These unconventional truss assemblies drastically reduced the required steel tonnage, and their depth also reduced the required section sizes, allowing all material for the buildings to be acquired domestically.

The upper floors are contained in a copper-clad box structure that is elevated above the exterior terrace level and rotated 20° relative to the main building grid. This configuration created long cantilevers at each of the four corners of this copper-clad box. In addition, the structure used to support the copper-clad box is exposed and visible within the building at the ballroom level and silhouetted at night when backlit through the copper cladding. Site-assembled trusses act as both the structural support for the roof and the backup for the copper cladding, and cantilever at all four corners of the box, up to 117 ft.

The top of the podium level is an exterior terrace, accessible from both the ground and from the third-floor conference level by exterior monumental stairs. The terrace extends

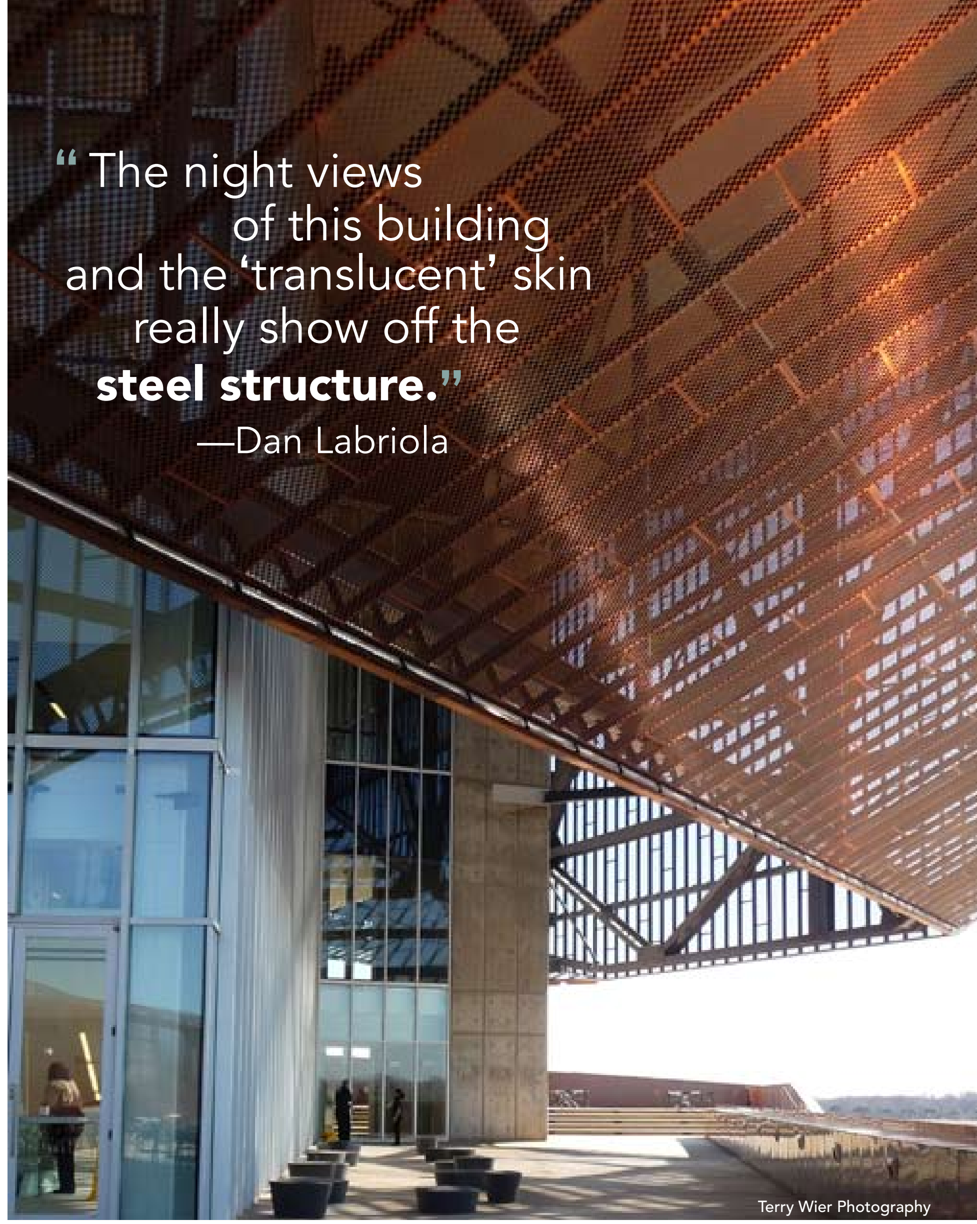


Terry Wier Photography



Terry Wier Photography

Datum Engineers



"The night views of this building and the 'translucent' skin really show off the **steel structure.**"
—Dan Labriola

Terry Wier Photography

the entire length of the south side of the building, including above the two main entrances on the lower-level corners. These entries were conceived by the architect as floor-to-ceiling glass wrapping the corners, without visible structural support. To achieve this, Datum Gojer designed two sets of trusses, cantilevering as much as 150 ft toward the corner in each direction. These trusses were analyzed together to reduce deflections at the head of the glass and minimize vibrations of the occupied terrace.

Minimizing the weight of the elevated box structure while maintaining good vibration performance in the ballroom and meeting rooms was a significant challenge, and the weight of the floor plates directly affected the steel tonnage required for the long-span catenary and arch trusses over the floor. The final upper-level floor assembly uses castellated beams at 15 ft on center, supporting a lightweight concrete slab. This system minimized steel tonnage while also offering a relatively stiff floor.

Owner/Developer
Irving Convention Center, Irving, Texas

Owner's Representative
Beck Group, Dallas

Architect
RMJM (formerly Hillier), Princeton, N.J.

Structural Engineer
Datum Gojer, Dallas

General Contractor
Austin Commercial, Dallas

Steel Team

Steel Fabricator
W&W Steel, Oklahoma City, Okla. (AISC Member/AISC Certified Fabricator)
North Texas Steel, Fort Worth, Texas (AISC Member)

Steel Detailer
International Design Services Inc., Maryland Heights, Mo. (AISC Member)

Steel Erector
Bosworth Steel Erectors, Dallas (AISC Member/(AISC Advanced Certified Steel Erector)

Merit Award—Greater than $75 Million

UCSF RAY AND DAGMAR DOLBY REGENERATION MEDICINE BUILDING, SAN FRANCISCO

Big things are being studied at a tiny level at the new Ray and Dagmar Dolby Regeneration Medicine Building (RMB), perched behind the University of California, San Francisco (UCSF) Parnassus Medical Center in San Francisco.

The 68,500-sq.-ft facility houses 25 principal investigators and their teams whose job it is to study tissue development and cell-based approaches to treating diseases. The building's design encourages collaboration through the creation of four open labs, which are interconnected by shared break rooms and offices that look out upon green roof terraces. The design was based on conceptual "bridging" drawings developed by Rafael Viñoly Architects of New York and the San Francisco office of Nabih Youssef Associates.

The 650-ft-long by 65-ft-wide building sits on a steep hillside adjacent to an existing access road—the vertical slope of the hill is almost 60° towards the western end—and the plan mimics the serpentine shape of the road as it twists and turns up the hill. Each of the four open labs is contained in a structural "pod," each 150 ft in length. The pods terrace up the hillside from east to west with a one-half story step between each pod. The westernmost lab aligns with the grade of the existing access road grade; however, the road's steep gradient creates a large elevation difference between the eastern lab and the road below. As a result, some foundation elements cantilever above grade by as much as 30 ft.

Each pod consists of a conventionally framed steel superstructure supported by an HSS space truss below. Exterior walkways are cantilevered 7 ft to 14 ft off the north side of the building to provide additional circulation between the pods. The space truss provided an efficient means of accommodating the horizontal sweeps of the road and vertical slopes of the terrain. Early collaboration with the steel fabricator and erector, Schuff Steel, allowed the truss details to be coordinated with their fabrication and erection plan. In some cases, more fabrication-intensive connections were favored to expedite field construction and improve the reliability of the final product. This collaboration, in combination with the use of building information modeling (BIM), significantly reduced the number of RFIs and kept the structure on schedule and budget.

The HSS space truss and exterior walkways were exposed in their final condition. As such, architecturally exposed structural steel (AESS) requirements were incorporated into their design and construction. These requirements varied from simply removing weld and erection aids for visually distant members to grinding welds, providing constant gaps and aligning bolt heads for more accessible areas. Working with UCSF, the design-build team was able to balance their aesthetic needs with the budgetary limitations to produce an elegant and dynamic exposed structure.

Because of RMB's close proximity to the San Andreas Fault (about six miles), UCSF desired an increased level of seismic performance for the structure to protect the building and its contents from damage in a significant earthquake. Given the unique architectural design and stringent performance requirements, base isolation was selected as the design solution that best balanced the project requirements. "Triple Pendulum" isolation bearings, manufactured by Earthquake Protection Systems of Vallejo, Calif., were selected because of their ability to limit the torsional response of the long and narrow structure. Based on nonlinear response history analysis, the structure is anticipated to move a maximum of 26 in. laterally and 2 in. vertically during a maximum considered earthquake.

Initial analysis indicated that the narrow building configuration resulted in the tendency for the structure to "tip" during an earthquake. Since the isolation bearings cannot resist tension directly, the team had to conceive a solution that could resist the required 200-kip tension force at any point of the building's travel. Structural engineer Forell/Elsesser, in collaboration with Schuff Steel, created a custom dynamic uplift restraint device, which consists of two pairs of rollers that ride on curved tracks that are interconnected by an articulating linkage assembly. The performance of the uplift restraint was successfully verified by shake table testing at the University of California, San Diego.

The building is connected to the ninth floor of the adjacent Medical Sciences Building by a 140-ft-long steel bridge, which uses "through" plate girders to span the long distance. An architecturally exposed HSS and bare metal deck roof provide pedestrians sanctuary from the elements. The bridge is vertically supported by an 8-ft-diameter concrete shell at the north end and a steel service elevator tower to the south. The concrete shell and steel tower also provide lateral support for the bridge by cantilevering from their foundations more than 90 ft below. The bridge is seismically separated from RMB and the Health Sciences Building to permit the anticipated 3 ft of differential lateral movement.

RMB is the first LEED Gold Certified project to receive an Innovation in Design (ID) Credit for high-performance seismic design. Forell/Elsesser was able to show that the base isolated design resulted in a 40% reduction of structural materials and 43% reduction of CO^2 over a conventionally designed structure of equal seismic performance. In addition, the design-build process saved UCSF approximately $20 million and two years on their schedule.

Bruce Damonte Photography

“A **uniquely challenging** building that would have been impossible to build without steel.”
—Eric Liobis

Bruce Damonte Photography

Bob Canfield

Owner/Developer
University of California, San Francisco Capital Programs and Facilities Management, San Francisco

Owner’s Representative
Nova Partners, Palo Alto, Calif.

Architects
Rafael Viñoly Architects, New York
SmithGroupJJR, San Francisco

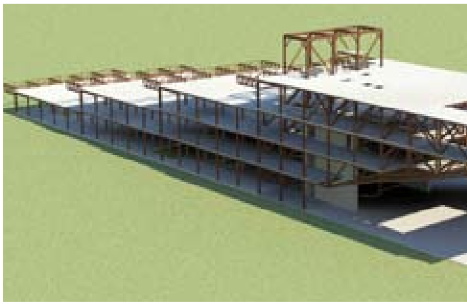
Structural Engineers
Forell/Elsesser Engineers, San Francisco
Nabih Youssef Associates, San Francisco

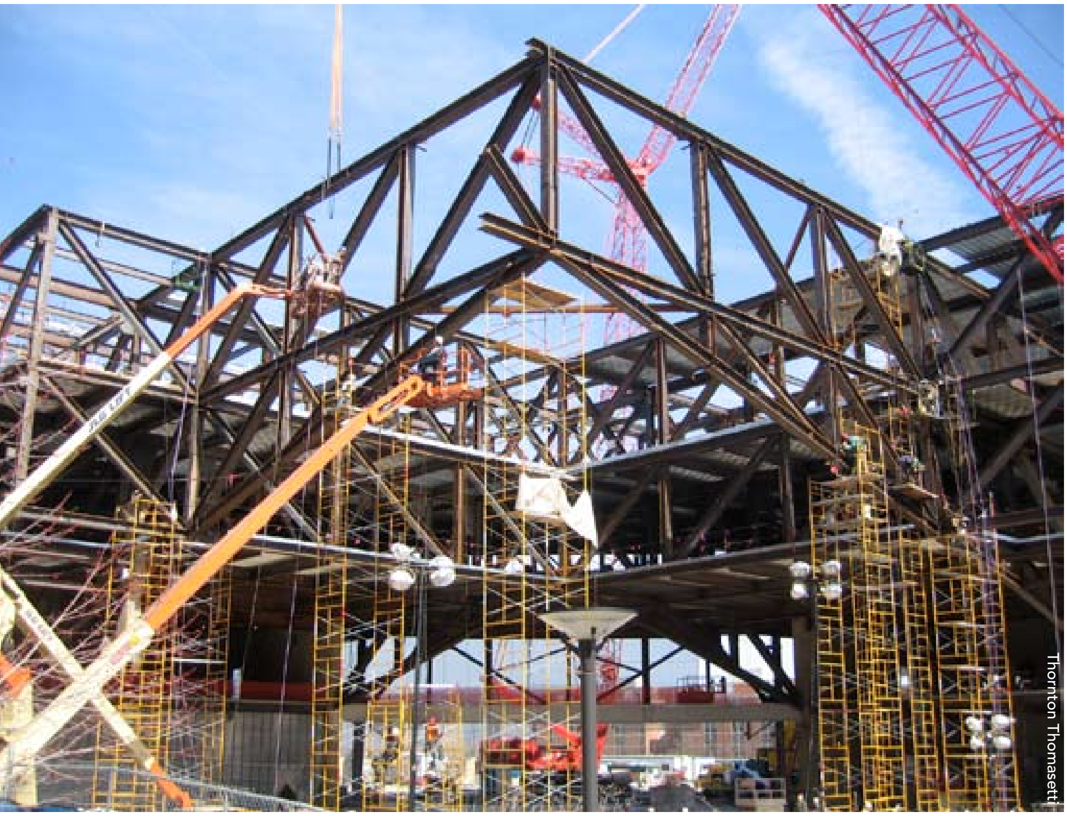
General Contractor
DPR Construction, San Francisco

Steel Team

Steel Fabricator and Erector
Schuff Steel, San Diego (AISC Member/AISC Certified Fabricator; AISC Advanced Certified Steel Erector)

" What a **cantilever**! "
—Dan Labriola





Thornton Thomasetti

Rafael Viñoly Architects

Thornton Thomasetti

Dan Palotas

Merit Award—Greater than $75 Million

PENNSYLVANIA STATE UNIVERSITY—MILLENNIUM SCIENCE COMPLEX STATE COLLEGE, PA.

Penn State's Millennium Science Complex was conceived to create shared and specialized spaces to house the Huck Institutes of the Life Sciences and the Materials Research Institute. Together, the Institutes provide hands-on opportunities for research in human health, energy and materials science.

The 275,600-sq.-ft building consists of two four-story wings that each cantilever 154 ft to meet over a dramatic entrance plaza, with an opening in the roof structure to allow sunlight to reach the garden below. Constructed upon micropiles, the building is an all-steel framed structure with concrete reinforcement and is clad in a combination of precast, curtain wall and metal panels. Moment and braced frames comprise the lateral force resisting system in the wings of the building.

One of the Institutes' goals was to build laboratory facilities capable of housing highly sensitive and specialized equipment and instruments, along with conference spaces, common areas and office space for faculty and research staff. The specialty areas include 40,000 sq. ft of quiet labs requiring shielding from vibration and electromagnetic noise, and a 10,000-sq.-ft nano-fabrication laboratory requiring clean room access and vibration protection.

The design team located the nano-fabrication lab within a structurally isolated area that floats within the building to eliminate vibration from surrounding effects. In addition, typical bay sizes were restricted to 22 ft by 22 ft to achieve better vibration performance. The quiet labs are also structurally isolated from the rest of the building and situated on 24-in.-thick slabs on grade beneath the plaza of the complex.

The cantilever is supported by two tapered steel trusses, one per wing, both of which involved intricate connection designs that were complicated by numerous simple-span trusses and braced hanger frames framing into the tapered trusses. Wind tunnel tests were conducted to overcome the isolation issues and to determine possible vibration effects from multi-directional wind loads on the cantilever—a critical factor in a laboratory building with sensitive equipment.

Overall, the Millennium Science Complex uses 4,200 tons of steel, which took 60,000 labor hours to fabricate. Erection of the steel framework took 22,000 hours using four cranes and a peak of 75 iron workers, with some field welds taking as long as three 10-hour days apiece to complete. Erection consultant C.S. Davidson provided an erection sequencing plan, complete with an analysis of the anticipated deflection, and designed temporary shoring columns to support the cantilever trusses during construction. Steel erection was so complex and the design required such high accuracy that a local survey firm, Sweetland Engineering & Associates, Inc., was brought in to take readings of the cantilever trusses during construction to ensure accurate placement.

The entire project team, led by structural engineering firm Thornton Tomasetti, collaborated effectively in the use of building information modeling (BIM) technology, using Autodesk Revit as a primary tool for information exchange and coordination during the design and construction phases. This enabled the whole project team to be consistent with each design aspect throughout the duration of the project—a necessity on such a large and complex design. Using BIM also allowed steel procurement and detailing to be expedited, reducing construction costs and keeping the project on schedule.

Owner/Developer
Penn State University, University Park, Pa.

Architect
Rafael Viñoly Architects, New York

Structural Engineer
Thornton Tomasetti, Newark, N.J.

Connections Engineer
C.S. Davidson, Inc., York, Pa.

General Contractor
WhitingTurner Contracting, State College, Pa.

Steel Team

Steel Fabricator and Erector
Kinsley Manufacturing, York, Pa. (AISC Member/AISC Certified Fabricator; AISC Advanced Certified Steel Erector)

SDI Structures

SDI Structures

SDI Structures

"The building defines how modernity **can coexist** with tradition."
—Asma Momin

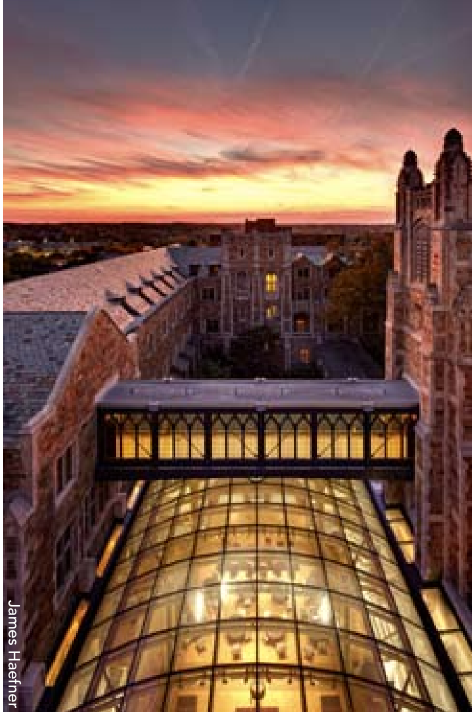
National Award—$15 Million to $75 Million

ROBERT B. AIKENS COMMONS – UNIVERSITY OF MICHIGAN LAW SCHOOL, ANN ARBOR, MICH.

The University of Michigan Law School, constructed in the 1930s around a quadrangle on the Ann Arbor campus, inhabits one of the most beautiful examples of university gothic architecture in the country. And while the tree-shaded open spaces and the cathedral-like library are among the most cherished spaces on campus, the Law School itself has always lacked a central community space to bring its members together.

The Robert B. Aikens Commons was conceived to fill that void, providing students, faculty and staff with a meeting space that would draw them together in a public square. A long-neglected courtyard, nestled between grand academic halls, was selected as the location for this new community space. Hartman Cox-Architects envisioned a grand sky-lit atrium and selected steel to create a stunning meeting space that complements and accentuates the surrounding historic structures.

The atrium roof is a lattice of gently curved HSS 8×3×14 members, consisting of 54 curved ribs and four tiers of purlins. These members allowed for exceptionally clean detailing and were pre-assembled in the fabrication shop prior to being shipped segmentally to the site for erection. The roof is supported by eight tree-like columns fabricated from W24×84 sections. Each column extends through the main


James Haefner


SDI Structures

floor slab to the lower-level space below, providing an opportunity to create fixity at the column where it penetrates the slab. This fixity creates lateral stability for the atrium, which is subject to unbalanced wind loads and snow loads. An HSS perimeter member creates an attachment surface for both a gutter and an expansion joint. The lateral stability created by the trees, working in conjunction with the perimeter expansion joint, ensures that virtually no gravity loads and no lateral loads reach the walls of the historic stone structures surrounding the courtyard.

Besides creating a successful community space, improvement of pedestrian traffic routes between the Law School buildings was also necessary, and a new Gothic-style HSS truss bridge, crossing over the atrium, spans between two buildings: Hutchins Hall (an academic building) and an unused tower in the adjacent William W. Cook Legal Research Library. The pedestrian route is completed, despite a significant change in elevation, through use of a two-stop elevator cradled in the tower on a new grid of W24×94 members.

Owner/Developer
University of Michigan Law School, Ann Arbor

Architects
Integrated Design Solutions, Troy, Mich.
Hartman-Cox Architects, Washington, D.C.

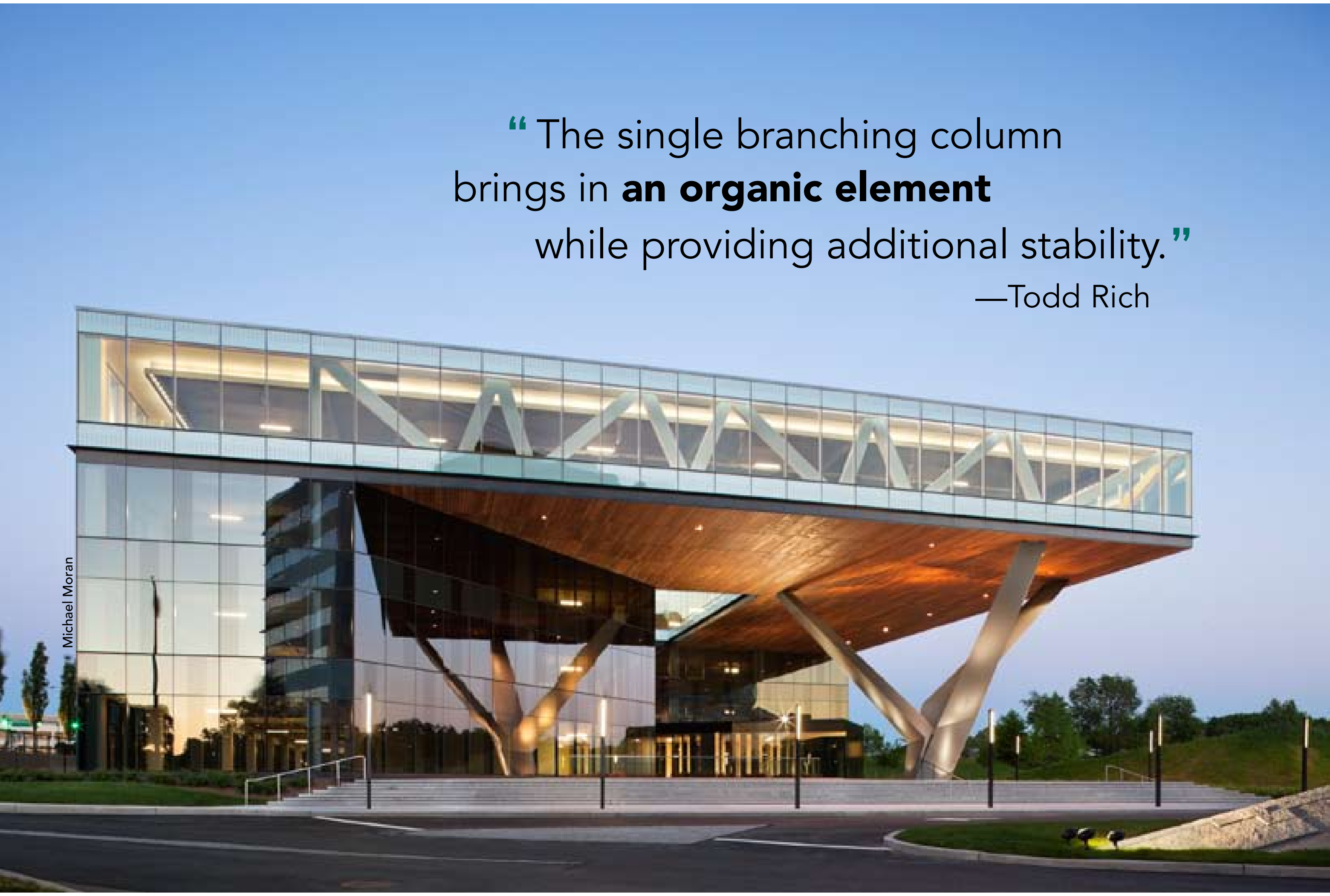
Structural Engineer
SDI Structures, Ann Arbor

General Contractor
Walbridge, Detroit

National Award—$15 Million to $75 Million

CENTRA AT METROPARK, ISELIN, N.J.

"The single branching column brings in **an organic element** while providing additional stability."
—Todd Rich



Michael Moran

The Centra at Metropark office building was built with expansion in mind, in terms of both adding to an existing project and encouraging future additions. The project involved renovation and expansion of an existing four-story office building, adding 30,000 usable sq. ft to an existing 80,000-sq.-ft building to draw future development to the site. Light wells were added to the existing 20,000-sq.-ft basement and a central oculus was constructed, making the space usable. An additional 10,000 sq. ft was added above the roofline, adding a fifth floor.

The architect envisioned a high ceiling at the entrance of the building in order to allow light into the basement. This was achieved by reconfiguring and expanding the topmost office floor plate from an L-shape to a rectangle. With a goal to have a minimal column foot print area, a 50-ft-tall signature "tree" column was created for the addition. The column's "trunk" extends from the ground and then branches out in three directions to support the long-span trusses carrying the expansion.

The top of the branches connect at the fourth floor to form a triangle while the center trunk support is located at the centroid of this triangle to minimize unbalanced moments on the column. The sectional area of the branches was reduced with the height, and the entire tree column was constructed using 1-in.-thick plates welded together. Lateral forces due to unbalanced loads were calculated, and these loads were included in the analysis and design of the building's lateral system. A 5-ft-thick isolated footing was designed to support the tree column loads, and this footing was anchored at four corners using rock anchors to prevent uplift from overturning.

The tree column, including the branches and the trunk, had to be fabricated separately. Three strategically placed splice locations were chosen, and the pieces were lifted onto scaffolds and welded in place. The architect, Kohn Pedersen Fox, wanted a "floating structure" appearance on top of the branches and trusses at the fourth floor. Therefore, the faces of the branches were offset in-board right below the fourth floor soffit, and a smaller triangular stub was continued to connect to the underside of the long-span trusses. The inside of the tree column was filled with concrete at the site to add lateral stability.

Two 120-ft floor-height trusses at the south and west sides of the fourth floor were designed to carry the loads imposed from the fourth floor and the roof. The architect wanted to mimic the tree column's irregularity in the exposed diagonals of the trusses, so the truss panel point spacing was varied. Each truss spanned 96 ft between supports and cantilevered out 24 ft to the other truss in the perpendicular direction. All truss diagonal connections to the top and bottom chords were welded, and the existing perimeter columns supporting these trusses had to be significantly reinforced with structural steel plates. The footings supporting these columns were also enlarged to accommodate additional gravity loading.

The new addition added considerable lateral wind and seismic loads to the existing moment framed steel structure that had to be resisted by the lateral system. The existing system was unable to take the additional loading and was abandoned for a new braced frame retrofit. Five new braced frames were located around the existing elevator and stair cores and were designed for the entire building's lateral loading, as well as for the unbalanced load from the tree column. These braces were located between the existing columns, which were reinforced with steel plates for additional loading. The spread footings at these columns were also enlarged by doweling the reinforcing into the existing footing and also installing post-tensioning rods. Rock anchors at these footings were also used to hold down the lateral columns.

The project is pursuing LEED certification. By opting not to tear down the existing building and reusing the existing steel structure, floor plates, roof deck and 50% of the core elements, waste was considerably reduced and valuable resources saved.

Owner/Developer
Hampshire Real Estate Cos., Morristown, N.J.

Architect
Kohn Pedersen Fox, New York

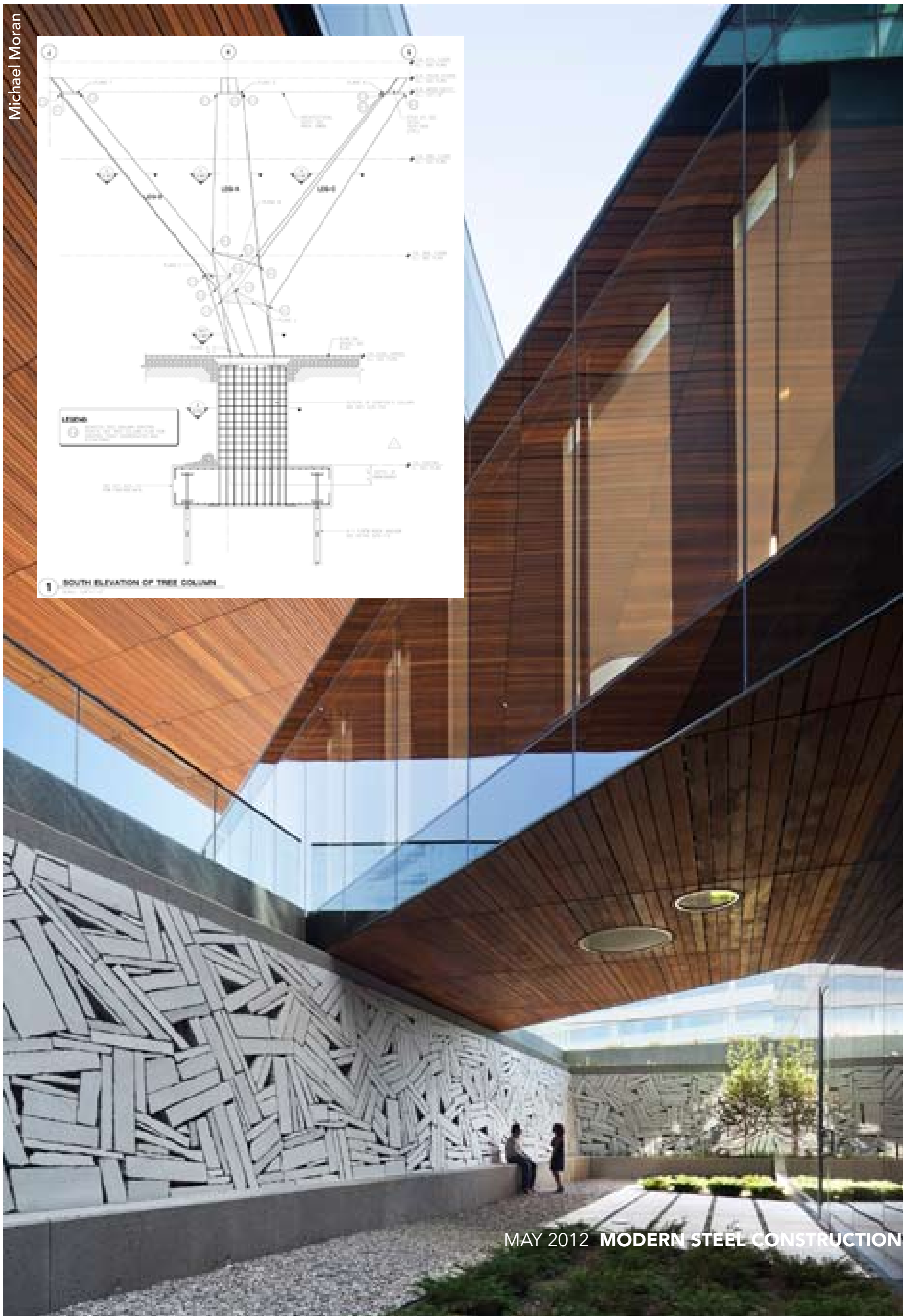
Structural Engineer
DeSimone Consulting Engineers, New York

General Contractor
Tishman Construction Corp., Newark, N.J.

Steel Team

Steel Fabricator
Berlin Steel, Malvern, Pa. (AISC Member/AISC Certified Fabricator; AISC Advanced Certified Steel Erector)

Desimone Consulting Engineers



Michael Moran

National Award—Less than $15 Million

ROBERT I. SCHRODER PEDESTRIAN OVERCROSSING, WALNUT CREEK, CALIF.

The new Robert I. Schroder Overcrossing provides safe passage for pedestrians and bicyclists over a major traffic intersection in Pleasant Hill, Calif. The bridge is the centerpiece of a transit village consisting of commuter railway station and a high-density, residential and commercial development, and serves both commuters approaching the station and recreational users of the 33-mile long Iron Horse Trail.

Surrounding elements—transit easements on the trail's surface for a future light-rail or streetcar system, 115kV power lines hanging directly over the project site, oak trees that the community was determined to preserve, underground utilities and multiple property rights issues—created boundaries within which the bridge's design needed to fall (although the overhead power lines were eventually moved slightly). To avoid hitting the trees and utilities, the design team twisted the bridge's body into an elongated S-shape. In order to take up as little surface space as possible and avoid hitting any underground utilities, the structure relies on an unusual support system; the arches on either side emerge from a single common point at ground level, then tilt away from one another at approximately 20° as they rise, leaving room in the middle for the bridge deck to rest. As a result, the support infrastructure underneath takes up only about half the space of a typical bridge.

To encourage community buy-in and create a lasting point of pride for the region, the team placed a great deal of emphasis on the bridge's aesthetics. While there are no parts on the bridge that are exclusively decorative—every element serves either a structural or safety function—each design decision was carefully considered from a visual and a functional perspective. For structural components, this meant making each piece as light and elegant as possible. The most visible structural support, the double arches, comprise welded groupings of three 10-in.-diameter HSS members, which are joined by steel plate stiffeners at 14-ft intervals and bent continuously to form curves. The three-pipe grouping creates intricate shadow displays that change throughout the day and a visual rhythm that gives the structure a sense of dynamism. The two ground-level support structures consist of three slim concrete pillars, two of which are tilted to the angle of the arches, and appear almost too slim and delicate to support the bridge's weight.

To create a feeling of openness, structural engineer Arup also eliminated the need for the arch segments to touch above the deck. A steel beam linking the two pairs of inclined buttress columns that support them under the deck ensures adequate structural support, giving pedestrians and bikers an unobstructed view of the sky.

The underside also received consideration due to its visual prominence from the ground. Because it acts as a continuous beam running throughout the bridge, suspended from the arches by structural hangers, Schroder's deck requires only about 2 ft of depth at its thickest point, rendering it considerably less bulky than most comparably sized bridge decks. This slender profile is enhanced by the curving underside, shaped to resemble the hull of a boat, a modification that also increases rigidity. Regularly shaped ribs provide visual rhythm to the deck, making visible the structural action of the hangers supporting it.

The project team's emphasis on intelligent, efficient use of materials translated directly into a more environmentally friendly project. The push to craft a lightweight, minimal design with no superfluous elements significantly reduced the amount of steel used in the bridge; the total count was only 230 tons, or an average of 66 lbs per square foot, of deck plan across the entire structure—a very small figure compared to most bridges of this type.

Owner/Developer
Contra Costa County Public Works Department

Architect
MacDonald Architects, San Francisco

Structural Engineer
Arup, San Francisco

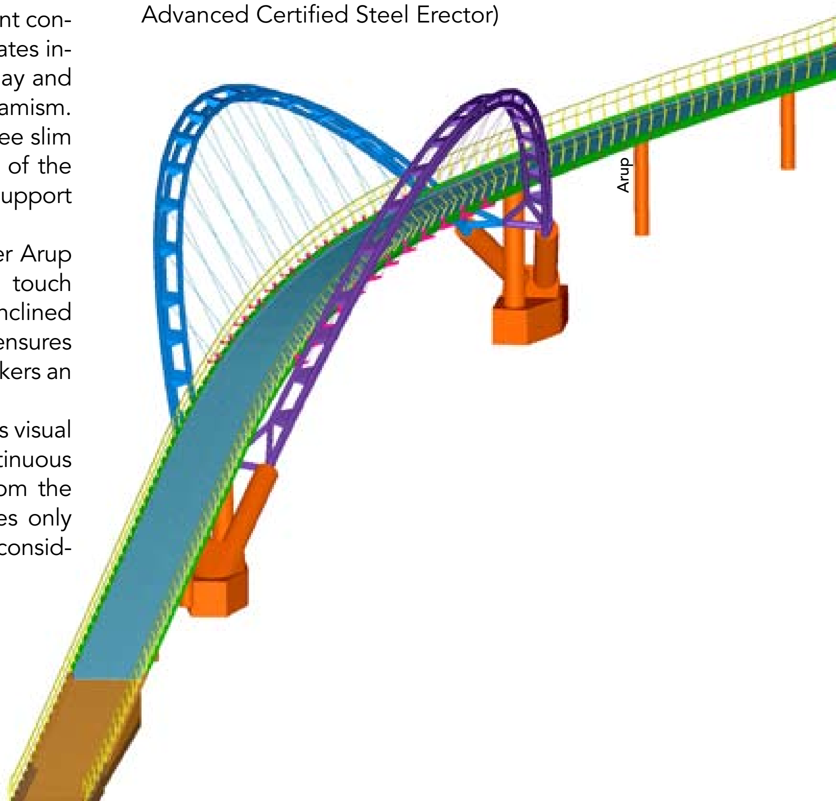
General Contractor
Robert A. Bothman, Inc., San Jose, Calif.

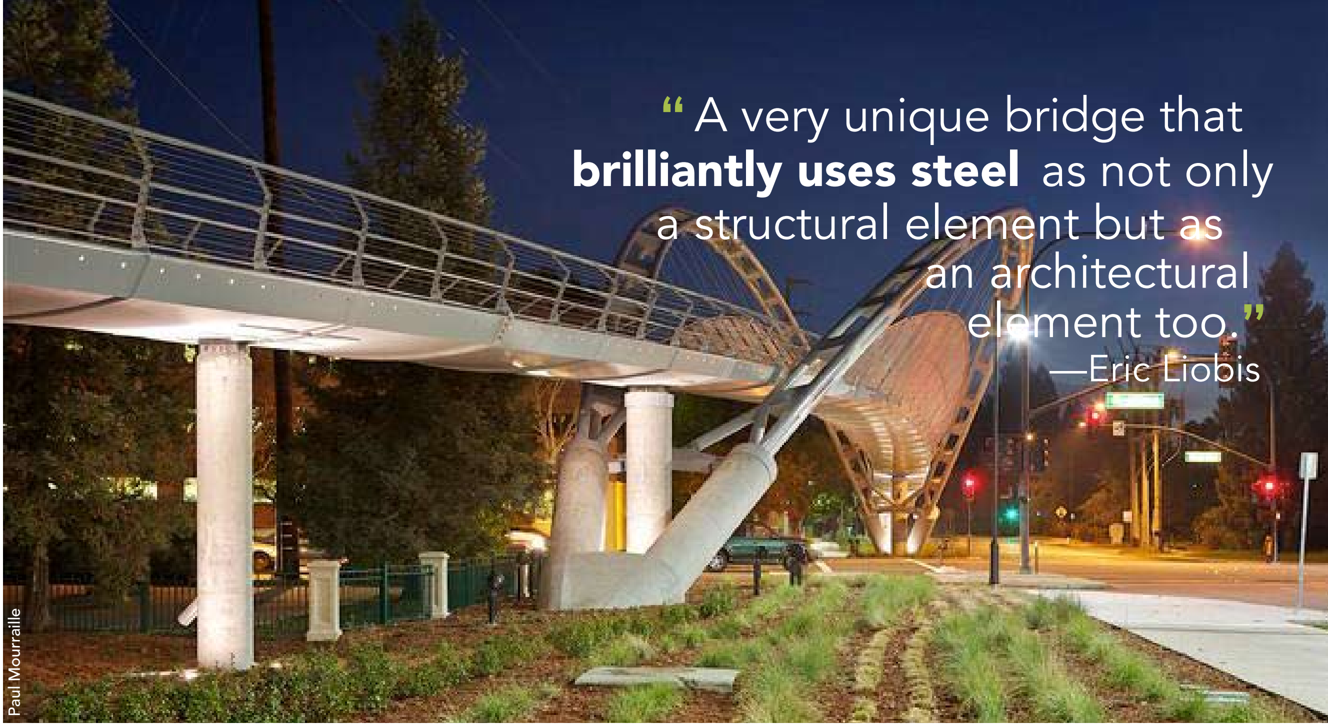
Steel Team

Steel Fabricator
Mountain States Steel, Lindon, Utah (AISC Member/AISC Certified Fabricator)

Steel Detailer
Axis Steel Detailing Inc., Orem, Utah (AISC Member)

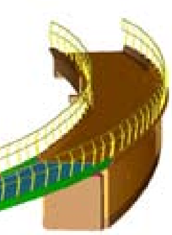
Steel Erector
Adams & Smith Inc., Lindon, Utah (AISC Member/AISC Advanced Certified Steel Erector)





Paul Mourraille

> “A very unique bridge that **brilliantly uses steel** as not only a structural element but as an architectural element too.”
> —Eric Liobis



Glenn Fleming

Paul Mourraille

> "The potential of **steel design** is apparent in the free formed and unique geometry of the building."
> —Asma Momin

National Award—Less than $15 Million

CAMPUS COMMONS – THE STATE UNIVERSITY OF NEW YORK, NEW PALTZ, N.Y.

The State University of New York at New Paltz has taken a new approach to the concept of a university commons area. The new Campus Commons on the school's campus is a three-level steel and glass "winter garden" addition to a 1970 student union building. Taking its inspiration from the forms of the nearby Shawangunk Ridge, it spans over and fills in a previously underutilized plaza courtyard.

In order to span over and enclose the courtyard with a column-free space that will also allow for future flexibility, the project team designed a structural tube "stress skin" system for the addition that recreates the angular forms of Shawangunk Ridge, an internationally known rock palisade in the nearby Catskill Mountains. Uniform 4-in.-sq. HSS sections were fabricated in large planar sections in the shop, then erected on-site before being spray-coated with intumescent paint to meet the required fire rating. The erection of the entire steel enclosure was completed in less than two weeks.

To resist the dead load and wind uplift on the roof, a 1-in.-diameter stainless steel cable and 2-in. down rods were used to transform the stress skin on the horizontal roof plane into a series of trusses and hold-downs. Ceramic fritted glass, patterned with an abstracted digitized version of the tectonic plates of the Shawangunk Ridge, was placed on top of the stress skin to create the enclosure.

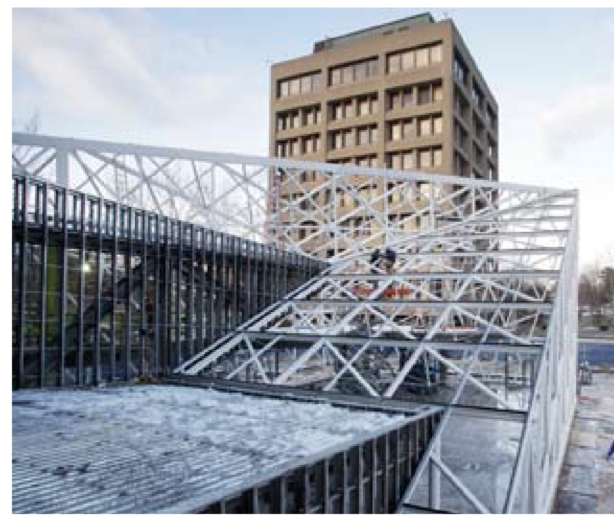
The distinctive geometry of the steel and glass enclosure demanded creative use of structural analysis and design software, as well as sequential prefabrication of portions of the steel assembly. Ikon.5 architects, Robert Silman Associates and Altieri Sebor Wieber (the mechanical engineer) worked intensely and collaboratively in integrating the architectural, structural and infrastructure systems, as all of these systems are exposed and therefore part of the visitor's experience.

Structurally, the atrium is composed of six main surfaces (eight if you include the small beveled corners), with an exposed superstructure of tubes and cables that form a column-free net on which glass panes are placed. Welded HSS members, 4 in. by 4 in., provide the majority of the structure. Because of snow load, the HSS on the upper and lower roofs is supplemented with steel bars and cables to form out-of-plane trusses, where the HSS acts as the top chord. The HSS on the roofs is supplemented by hold-down cables anchored down to panel points on the sidewalls to address wind uplift.

The "ridge" surface is formed geometrically as the step in elevation between the low roof and the high roof, and the 100-ft spanning "truss" formed by the HSS in this plane was increased to 14-in. by 4-in. members for the top and bottom chords. Field connections to assemble the atrium surfaces onsite were generally performed by welding at exposed locations and bolting at hidden locations.

The steel of the atrium is supported on a more conventional

All photos in this spread by Peter Mauss, Esto Photographics.



structure at the new occupied floor level: steel framing with concrete slab on deck, with lateral resistance provided by moment frames and braced frames. A partial floor mezzanine also floats within the space, supported partly by columns and partly by rod hangers up to the ridge truss. The new structure is founded on mini-caissons down to rock, with concrete caps and grade beams supporting the basement slab. It is seismically separated from the existing plaza and building complex.

Working within a strict budget of a publicly funded project, the design used repeated structural sections types in the steelwork, which served to simplify fabrication. In addition, varying the HSS wall thickness reduced the overall steel tonnage, making it cost-effective without sacrificing aesthetics. With the expressed steel grid, a very economical glazing system could be employed and easily installed due to the relative frequency of local structural support.

The expressive new addition improves the experience of entering the university while tying the campus back to its surrounding, distinctive landscape. Set upon the existing concrete plinth, the new structure draws an intense but elegant contrast between the old and new construction. The 12,000-sq.-ft addition includes meeting rooms, a game lounge, a study mezzanine, group study rooms and a large, informal commons, while the revitalized 10,000 sq. ft of space in the adjacent existing building accommodates the renovated bookstore, a food court and a gallery for social functions.

A sustainable, high-performance building, the new commons has been designed to reduce energy consumption and provide a healthy, light-filled interior environment for the campus community. The ceramic-fritted glass enclosure permits transparency while controlling solar gain, and low- or zero-impact mechanical and electrical support systems are included throughout. The Commons is designed to achieve a LEED Silver certification through its use of daylight harvesting and views, radiant heating and cooling, use of recyclable materials and photo-optic lighting controls.

Owner/Developer
The State University of New York at New Paltz

Architect
ikon.5 architects, Princeton, N.J.

Structural Engineer
Robert Silman Associates, New York

Mechanical Engineer
Altieri Sebor Wieber, LLC, Norwalk

General Contractor
Niram Construction, Booton, N.J.

Steel Team
Steel Fabricator
Erection and Welding Contractors LLC, New Milford, Conn. (AISC Member/AISC Certified Fabricator)

Merit Award—Less than $15 Million

PEDESTRIAN WALKWAY—ST. JOSEPH'S MEDICAL CENTER, STOCKTON, CALIF.

The pedestrian bridge at St. Joseph's Medical Center in Stockton, Calif. is a 320-ft-long steel-framed covered structure that connects the existing hospital to a new patient pavilion.

The bridge has five equal main spans, each about 60 ft long, and one end span that is 20 ft long. The main columns are 20-in.-diameter HSS members located 6 ft outside of the walkway footprint. These columns extend vertically about 17 ft above the walkway roof. The walkway is hung from these main columns with rigid diagonal tension/compression members. The main columns penetrate the existing plaza level waffle structure and are supported by new footings at the basement level. The walkway at both ends is separated from the existing and new hospital buildings by seismic expansion joints.

The overall structural configuration is relied upon to effectively reduce column eccentricity by placing columns on both sides of the walkway so that the center of mass of the overall bridge is located very close to the center of rigidity of the columns. Internal redistribution of torsional forces is made possible by designing the walkway walls, floor and roof as full trusses. The resulting effective eccentricity in columns below the floor level is less than 1 ft whereas the apparent eccentricity at each column is about 11 ft. The torsional strength and stiffness of the walkway are also used to effectively "fix" the top of all eccentrically placed columns in two horizontal directions. The resulting lateral resisting system is equivalent to a moment frame structure in two horizontal directions even though it uses only one continuous "beam" (walkway truss) eccentrically placed outside the column lines.

The main columns and walkway longitudinal top and bottom chords are detailed and designed as continuous. All other members are designed as simply connected, including columns to the foundation, in order to reduce forces in the members and the foundation and to reduce the stress gradient in the joints and connections. The existing waffle slab at the plaza level is used as a lever point, along with the foundation pin connection, to efficiently create fixity at the base of columns, and the walkway structure is used to create fixity at the top of the columns. Therefore, the columns in this bridge act as though they are fixed at top and bottom in both directions, all by using simple end connections.

The resulting final configuration is very efficient as a structural system with a steel weight of about 830 plf. For comparison, an earlier design scheme with cantilevered wide-flange columns located directly under the bridge had an estimated structural steel weight of about 1,080 plf.

The bridge embraces the main arrival plaza linking the services of the new Women's and Children's Pavilion with the existing hospital. The overall shape of the bridge is very pleasing and dramatic in its curves, giving the viewer a feeling that the structure

Joe Fletcher Photography

"**Interesting visually** because of its geometry and attention to attractive detailing, **interesting technically** because of its efficient design, showing weight savings."
—Andy Johnson

ESE Consulting Engineers

Joe Fletcher Photography

is floating in space since, the slender supporting columns are placed eccentrically outside of the walkway footprint. HSS were used to reduce the overall dimensions, and twin round HSS members were used as wall diagonals to visually reduce the profile while at the same time increasing the number of connections and thus reducing the length and stress at each connection point.

Owner/Developer
St. Joseph's Medical Center, Stockton, Calif.

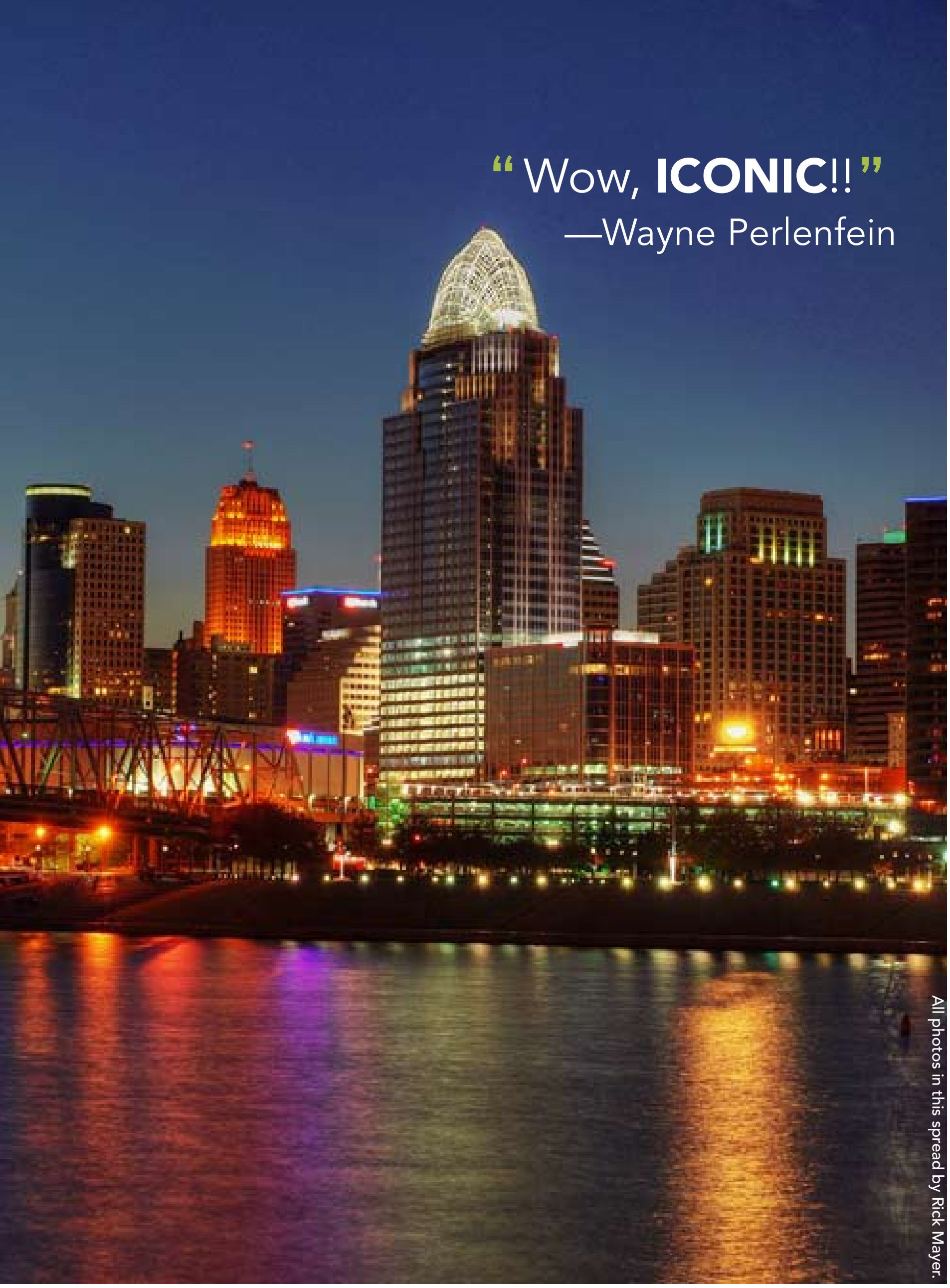
Architect
Anshen+Allen Architects, San Francisco

Structural Engineer
ESE Consulting Engineers, Benicia, Calif.

General Contractor
Turner Construction Co., Sacramento, Calif.

Steel Team

Steel Fabricator, Detailer and Erector
Olson Steel, San Leandro, Calif. (AISC Member/AISC Certified Fabricator; AISC Advanced Certified Steel Erector)



"Wow, **ICONIC**!!"
—Wayne Perlenfein

All photos in this spread by Rick Mayer.

Merit Award—Less than $15 Million

GREAT AMERICAN TOWER AT QUEEN CITY SQUARE ROOFTOP TIARA, CINCINNATI, OHIO

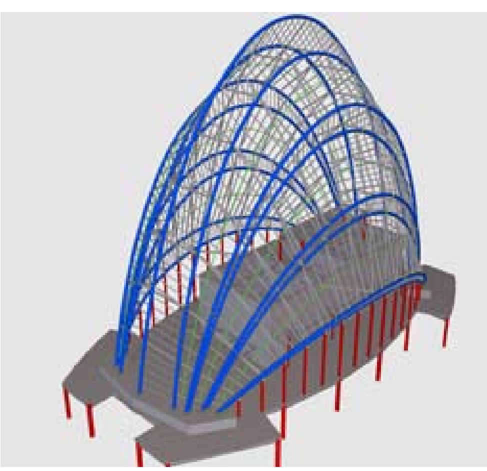
The steel tiara that crowns the 41-story Great American Tower at Queen City Square—Cincinnati's tallest building—is an iconic presence on the city's skyline.

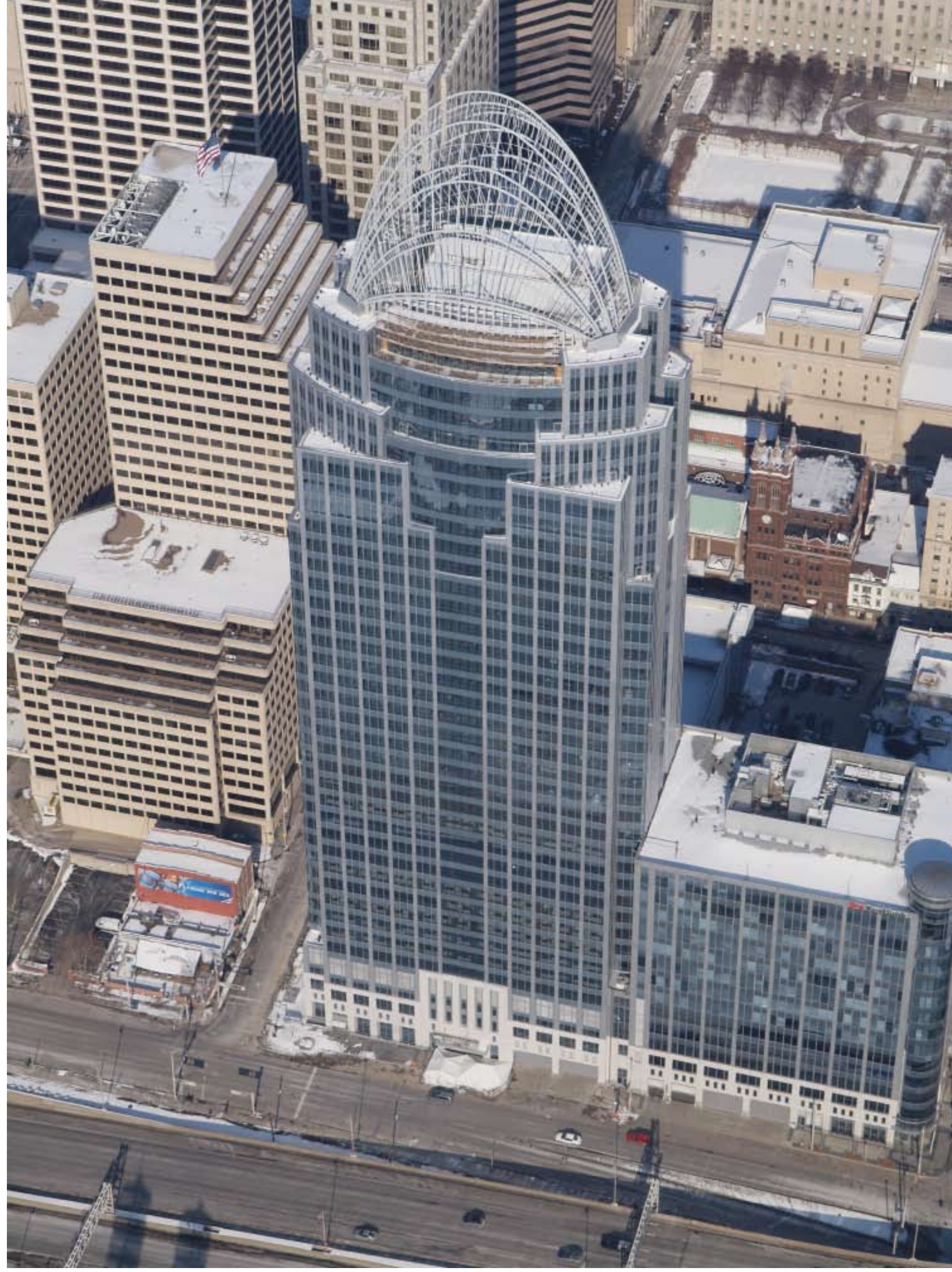
The 400-ton, 130-ft-tall tiara was conceived by Gyo Obata, a founder and design principal of HOK. Obata was inspired by a photograph of a tiara worn by Diana, Princess of Wales, and by Cincinnati's nickname, the Queen City.

Several design iterations were required to ultimately produce a cost-effective and graceful crown. Working closely with HOK, structural engineer Thornton Tomasetti helped rationalize the tiara's geometry and produced a structural framing layout that could easily be fabricated and constructed. Thornton Tomasetti also provided HOK with a detailed 3D Tekla model containing all proposed framing sizes, geometries and connection information. The Tekla model enabled HOK to approve the aesthetic appearance of the structure before shop drawing production, thereby facilitating a smooth shop drawing preparation and review process.

The tiara has a hyperbolic silhouette and its plan dimensions measure 159 ft in the east-west direction and 93 ft in the north-south direction. Geometrically complex, it is composed of 15 ornamental arch elements uniformly supported by 14 arching columns woven through the tiara, creating a two-way support system. It features more than 750 individual HSS elements, ranging in diameter from 4 in. to 16 in. The smallest of the tiara's members account for nearly 50% of the pieces and serve to improve the aesthetic appearance of the structure. Fundamentally, the tiara is a self-supporting, two-way space frame possessing stiffness and strength both vertically and laterally.

To overcome complexities associated with the irregular geometry of the tiara, Thornton Tomasetti collaborated closely with Owen Steel Company and Runyon Erectors regarding





shipping methods, delivery methods and potential erection procedures for structural steel framing members. Load-bearing structural framing members needed to be designed to the tightest tolerances. To help ensure this, Thornton Tomasetti suggested a network of subassemblies for these members that were shop fabricated, leading to fewer construction components and allowing for geometric verification of the elements before erection began. They also provided on-site fabrication consultation, assisting in the development of specialized tools that helped specify geometry of the members where control points were inaccessible due to their location within the volume of the HSS members. This collaborative, shop-intensive process amounted to 80% of the assembly effort, reducing the number of pieces handled in the field and resulting in a total number of field modifications not exceeding 1% of the more than 750 individual components of the structure.

Owner/Developer
Port of Greater Cincinnati and Eagle Realty Group, Cincinnati

Architect
HOK, St. Louis

Structural Engineer
Thornton Tomasetti, Chicago

General Contractor
Turner Construction Co., Cincinnati

Steel Team

Steel Fabricator
Owen Steel Company, Columbia, S.C. (AISC Member/AISC Certified Fabricator)

Steel Detailer
Thornton Tomasetti, Inc., Chicago

Bender-Roller
Chicago Metal Rolled Products, Chicago

“An example of **structural steel** that is able to go from brute strength to amazing grace in a single building.”

—Andy Johnson

All photos in this spread by Timothy Hursley.

Presidential Award of Excellence in Engineering and Architecture

KAUFFMAN CENTER FOR THE PERFORMING ARTS KANSAS CITY, MO.

The 400,000-sq.-ft Kauffman Center for the Performing Arts was designed to create a focal point for Kansas City's burgeoning arts district. And with a 1,600-seat concert hall, 1,800-seat ballet/opera house, café, garden and underground parking garage, it certainly commands attention.

Actually three buildings in one, the Kauffman Center required different structural approaches for different areas. In the two performance halls, for example, key issues included the need to create wide, column-free spaces and support the sound-reflecting concrete ceilings. Structural engineer Arup's solution included straight, long-span steel trusses (90 ft in the opera house and 115 ft in the concert hall) tapered in depth to provide greater strength where needed.

For the exterior shell, the geometrical complexity of the architectural design presented a very different challenge. For the unique toroidal roof, Arup devised an efficient truss system made of single-direction rolled steel. The design is based on roof trusses curved out of plane by rolling the truss chords to produce the toroidal shape. The trusses are laterally braced from rotation by the intermediate radial roof members (curved the hard way) and the constant tension imposed by the southern cable net. The multifaceted curved-back surface is also made of curved trusses, but this time curved in-plane. The various facets look different, but are actually identical rolled sections made to look unique by varying the center point of a constant radius.

When it came to the atrium, an exterior pre-stressed stainless steel cable net was used to support the roof and walls, thus avoiding the need for interior columns and beams, to achieve the desired spacious, open quality in the glass-roofed lobby. Splaying the external cables allowed lateral bracing to be omitted, as well as facilitated the use of clear, open glazed walls.

The structure's cable-net roof presented a number of unique opportunities for advanced collaborative engineering. Cables typically perform poorly in fires, and consequently require costly, bulky fireproofing sleeves. The fire and structural engineers worked together to eliminate the need to encase the cabling. For instance, for the passenger drop-off point, digital models demonstrated that substituting high-strength rods for cables on the building's exterior would permit the elimination of fireproofing (because mechanical connections have higher heat resistance, the rods dissipate the heat gained by the fire).

For the interior, Arup modeled the fire-induced release of several cables in a fire scenario, proving that those cables within the flames' reach were not critical to the vertical support of the glass. For the vertical column masts, which are critical to atrium support, intumescent paint treatments were used to keep profiles as slim as possible.

The architectural design features steel on the building's north-south-facing sides, which are curved, and concrete on the east-west-facing sides, which are flat. In the lobby, exposed stainless steel masts, cables and a truss spanning both walls combine with the massive glass walls to create a dramatic setting for events and gatherings. In the concert hall, stainless steel mesh forms the backdrop for the stage.

Modeling and analysis were particularly important to a structure with such an unusual shape, as was early integration and sharing of these models with specialty contractors. Sharing the stiffness results of the structural model with the cable

supplier and general contractor allowed the cable supplier to bracket anticipated structure movement and check glass deflection and warping. Likewise, the contractor shared the cable stressing and construction sequence with the design team. This allowed the design team to check the frame performance over the sequential stressing operation.

For the cables supporting the glass lobby structure, nonlinear analysis and form-finding were used to balance the effects of gravity, wind and other conditions and determine the most structurally efficient shape.

Of course, being a performance venue, acoustical considerations were of the utmost importance. To provide the best possible sound in the two performance halls, a "box-in-box" approach was employed. The dense concrete walls of the two performance spaces provide acoustical benefits. The halls are covered by long-span steel trusses supporting two separate layers of sound-reflecting concrete caps. These two buildings are then covered again by an external steel-trussed shell and glass roof. In the finished building, the outer steel shell roof helps block vibration and noise from the surrounding city, while the glass roof provides a circulation link between the halls.

In addition to acoustical benefits, the split in materials saved time and money and the construction schedule was shortened by several months. While the detailed design, approval and fabrication for the steel portions were underway, concrete was formed, cast and allowed to cure. As soon as steel fabrication was complete and the parts transported to the site, the rest of the building was assembled relatively quickly. MSC

Owner/Developer
Kauffman Foundation/Land Capital Corp., Kansas City, Mo.

Architects
Safdie Architects, Somerville, Mass.
BNIM Architects, Kansas City, Mo.

Structural Engineers
Arup, New York
Structural Engineering Associates, Kansas City, Mo.

General Contractor
J.E. Dunn Construction, Kansas City, Mo.

Steel Team

Steel Fabricator
Hirschfeld Industries, San Angelo, Texas (AISC Member/NSBA Member/AISC Certified Fabricator)

Connection Designer
Structural Solutions, Inc., Fort Worth, Texas (AISC Member)

Steel Erector
Midwest Steel, Detroit, Mich. (AISC Member)