



# 2018 IDEAS<sup>2</sup> AWARDS

## INNOVATIVE DESIGN IN ENGINEERING AND ARCHITECTURE WITH STRUCTURAL STEEL

All about the great ideas that became the winning projects in this year's AISC IDEAS<sup>2</sup> Awards competition.

**MODERN STEEL CONSTRUCTION** is proud to present the results of AISC's annual IDEAS<sup>2</sup> Awards competition. Why "IDEAS<sup>2</sup>?" Because the program recognizes Innovative Design in Engineering and Architecture with Structural Steel. Awards for each winning project are 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, owner and AISC member fabricator, erector detailer and bender-roller. New buildings, as well as renovation, retrofit and expansion projects, were eligible, and entries were asked to display, at a minimum, the following characteristics:

- A significant portion of the framing system must be wide-flange or hollow structural sections (HSS)
- Projects must have been completed between January 1, 2015 and December 31, 2017
- Projects must be located in North America
- Previous AISC IDEAS<sup>2</sup> award-winning projects are not eligible

This year's six 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 protection
- The aesthetic impact of the project, particularly in the coordination of structural steel elements with other materials
- Innovative uses of architecturally exposed structural steel (AESS)
- Advancements 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 steel fabricators, alternative methods of project delivery and sustainability considerations

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

- Under \$15 million
- \$15 million to \$75 million
- Over \$75 million

National and Merit honors were awarded in all three categories, and two Presidential Awards of Excellence were also given: one for Erection Engineering and the other for Adaptive Reuse.

This year's winners include a jaw-dropping public transit station at Ground Zero in Lower Manhattan, a historic-power-plant-turned-office-building in Toledo, a thin office tower with an even thinner base on a small parcel of land in Chicago and projects involving not one, not two but three NFL stadiums—one of them reminiscent of a Viking ship (you'll never guess which team). Read on for more on these and the rest of the winners.

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## Meet the Jury

**John Cross, PE**, AISC staff juror, is vice president of special projects for AISC. He is a frequent speaker at seminars and workshops focused on marketing, construction economics, sustainability and the early involvement of steel specialty contractors in the design and construction process. John is a voting member of the ASHRAE 189.1 Standard Committee for the Design of High-Performance Green Buildings and the Consensus Body of the Green Building Institute.

**Stephen F. Csernak, PE**, academic juror, has been a member of the Glenn Department of Civil Engineering at Clemson University since 2001. While at Clemson, he has taught the Capstone Design senior project course as well as the Structural Mechanics, Structural Analysis, Reinforced Concrete Design and Structural Steel Design courses. Since 2011, he has been the coauthor of the textbook *Structural Steel Design* with Jack C. McCormac. Prior to working at Clemson, Steve was a practicing structural engineer for 25 years with Delon Hampton and Associates in Washington, D.C., the structural department head of Enwright Associates, director of structural engineering with Stevens and Wilkinson and structural group leader with O'Neal, Inc., in South Carolina. Steve is a graduate of Clemson University, earning his BS degree in 1974 and his MS in 1976. He has been a licensed professional engineer in South Carolina since 1979.

**Brian Falconer, SE, PE**, engineer juror, is a principal with Severud Associates Consulting Engineers, P.C., in New York, and has been with the firm since 1990. He is on the New York City Department of Buildings Structural Technical Committee and participated in both the 2008 and 2014 city building code revisions. He is also a past president of the Structural Engineers Association of New York and is currently chairman of the SEaONY's SE Licensure Committee as well as a member of the Structural Engineering Institute's Structural Fire Protection and Seismic Effects Committees. Brian received his BS in architectural engineering at the University of Kansas and his MS in civil engineering from the University of Texas.

**Grant Gustafson, AIA**, architect juror, is an architect with NBBJ. Since joining the firm in 1991, he has worked as a project architect, technical architect and technical leader on health-care projects in California, Louisiana, Washington, Massachusetts, Oregon and Alaska. From 2009 to 2015, he was a delivery leader and project architect for the \$1.2 billion academic medical center in downtown New Orleans, a state-of-the-art replacement hospital campus. He has also worked on stadiums, high-rises, corporate campuses and master plans. Drawing on his 38 years of experience to resolve dilemmas and ensure design continuity throughout projects, Grant is particularly versed in cladding systems and the building envelope. He received his MA in architecture from Montana State University, where he taught from time to time while serving 12 years on the School of Architecture Advisory Council. In addition, his drawings have been exhibited at the Art Institute of Chicago and the University of Oklahoma Art Museum.

**Lynda Leigh, SE**, general contractor juror, joined Turner Construction in 2006 and has managed multiple high-profile commercial and institutional projects for the company. She is currently working on the Willis Tower Repositioning Project and the Obama Presidential Center. Prior to joining Turner, Lynda worked as a structural engineer in Chicago for eight years (1999 to 2006). While working in an engineering role for Holabird and Root, Chicago's oldest architecture firm, she ultimately advanced to become head of the structural engineering department. She has also worked as an architect in Chicago. Leigh earned her MS in civil engineering from North Carolina State University and her BA in architecture from the Illinois Institute of Technology.

**Jeff Yoders**, trade media juror, is the Midwest editor and associate technology editor for *Engineering News-Record* and has been writing about design and construction innovations for nearly 20 years. Based in Chicago, he is a two-time Jesse H. Neal award winner and multiple-time ASBPE winner for his construction technology coverage. Jeff previously wrote for *Building Design + Construction* and *CE News*. He has also written about materials prices, construction procurement and estimation for [www.metalmminer.com](http://www.metalmminer.com).



Jurors, from left to right: Lynda Leigh, John Cross, Jeff Yoders, Brian Falconer, Grant Gustafson and Stephen Csernak.



Zalk Josephs



MKA, Michael Dickter



MKA, Michael Dickter



## OVER \$75 MILLION | NATIONAL AWARD 150 N. Riverside, Chicago

**THE NEW 54-STORY**, 1.25-million-sq.-ft, Class A office tower at 150 N. Riverside in Chicago has captured national attention, thanks to its elevated perch at the edge of the Chicago River, span across seven active Amtrak lines, construction using cranes balanced on barges and gigantic lifts of the largest steel sections in the world.

And most obviously, its shape is unlike anything the city has seen in one of its skyscrapers. The tower features a very narrow structure at its base and a compact footprint that gradually extends diagonally to highly efficient, column-free floors above. The unique design was driven by necessity, not aesthetics, and the building's tapering lines only hint at the story behind its unique profile.

The building's prominent West Loop riverfront location sat undeveloped for nearly a century because traditional building designs would not fit or "pencil out" for the slender, restricted site. Just 85 ft at its widest, the site is hemmed in by the river and a 30-ft setback to the east, active Amtrak lines to the west and Lake and Randolph Streets to the north and south. It was a matter of finding the right design that would allow for high-rise construction while not overwhelming the site's footprint.

Above Level 8—the first full floor, which is positioned more than 100 ft above the plaza—the concrete core-supported tower looks like a typical 46-story steel-framed office building. From Levels 4 to 8, a four-story transfer truss with sloping columns "funnels" the tower out of Amtrak air-rights space on the west and onto the developer's land in a footprint equal to just 30%

of the tower's floor area. Although not similarly restricted, the building's east side was also designed to slope inward to balance forces and provide open access to the expanding Chicago Riverwalk. The building columns above the transfer truss used 65- and 70-ksi high-strength steel, strategically located to provide the most economical steel frame. The 65-ksi steel was used to eliminate standard pre-heat requirements for columns with shop-welded moment connections, and the project boasts the first use of 70-ksi rolled steel sections in the U.S.

All 16 sloping columns along the east and west building faces are 65-ksi W36x925, a first for Chicago construction, and a dramatic 85-ft-tall glass lobby wall "hangs" from the tip of the transfer truss at Level 8.

At the furthest north and south column lines, the sloping columns are part of a four-story steel truss. Each truss is supported by two mega-columns, each comprised of two W36x925 sections joined together to create an economical and compact super-column carrying 13,500 tons. Between the north and south column lines, the base of each sloping column bears on the central concrete core. At Level 8, a continuous 4-in. by 40-in. steel tension tie at each column line extends from one edge of the building to the other, passing through the core, to balance the horizontal thrusts. In this configuration, the entire tower is supported by only the slender core and the four mega-columns, resulting in a building aspect ratio of a virtually unheard of 20:1—three times that of traditional building designs.



Zalk Josephs



MKA, Michael Dickter



An innovative use of structural steel to address site restraints. This will be seen as an iconic Chicago building. —John Cross

Despite the size and complexity of the structural elements, all connections at the transfer trusses used bolted connections, thereby eliminating costly field welding. The orientation of select pieces was modified to provide efficient connection geometries, and field splice locations were carefully coordinated to minimize the number of erectable pieces while not exceeding shipping and crane limitations.

A precast concrete air-rights “overbuild” above the seven active Amtrak tracks was designed for surface-level staging during construction, then for parking, and finally a green plaza at completion, creating 1.5 acres of new space for a public park, amphitheater and public parking garage, allowing the Riverwalk to connect through the previously underused site. The overbuild could only be built between the hours of midnight and 5:00 a.m. each day due to Amtrak’s restrictions. To touch the ground at as few locations as possible, thus minimizing disruption and conflict with existing Amtrak infrastructure, 300-ton dual-casing rock-socketed micropiles were used to support the overbuild. These are the highest-capacity micropiles ever used in Chicago. The foundations supporting the Riverwalk are comprised of AISC’s new HP16 sections, with a capacity of 375 tons each—also a highest-ever-in-Chicago achievement in terms of H-pile capacity.

At the top of the building, a 12-tank tuned liquid sloshing damper (TLSD) manages building drift in a first-ever application (previous TLSD installations were used to manage accelerations only). A total of 12 tanks, six on the north side and six on the south, are arranged in three 20-ft-wide by 35-ft-long by 8-ft-tall two-

stacked layers, holding a total of 160,000 gallons of water (almost 700 tons). Once the building was complete, the water depth in the tanks was “tuned” to precisely match the building dynamics and most effectively combat lateral drifts and accelerations.

For more on the 150 N. Riverside project, see “Above and Beyond” at [www.modernsteel.com/150riverside](http://www.modernsteel.com/150riverside).

- Owner**  
Riverside Investment and Development, Chicago
- General Contractor**  
Clark Construction, Chicago
- Architect**  
Goettsch Partners, Chicago
- Structural Engineer**  
Magnusson Klemencic Associates, Inc., Seattle
- Design Consultant**  
ArcelorMittal, Chicago

- Steel Team**
- Fabricator**  
Zalk Josephs Fabricators, LLC, Stoughton, Wis. 
- Erector**  
Chicago Steel Construction, LLC, Merrillville, Ind. 
- Detailer**  
Ken Boitz and Associates, Inc., Bloomingdale, Ill. 

**OVER \$75 MILLION | NATIONAL AWARD**

# World Trade Center Transportation Hub (The Oculus), New York

**THE WORLD TRADE CENTER** Transportation Hub's Oculus structure sticks out like a sore thumb—albeit an elegant, artistic one.

With its steel “wings” of various lengths, it is one of the most eye-catching public transit stations in the world. The Oculus is the main transit hall in the new multi-billion dollar transit station in lower Manhattan that serves more than 200,000 commuters daily. The facility serves as the gateway for the 16-acre World Trade Center (WTC) site and houses Port Authority Trans-Hudson (PATH) train service to New Jersey while connecting to 11 New York City Subway lines.

The Oculus' iconic design was inspired by a pair of hands releasing a white dove. The glass skylight at the crown is retractable, and the orientation of the structure is such that each year on the morning of September 11th, the sun will align with the open roof and allow unfiltered light to fill the station below.

Typical of Santiago Calatrava structures, the project is striking in its architecture but challenging to build. The design consists of two parallel arches spanning across a 300-ft-long oval-shaped opening in the transit hall roof slab and reaches a crown height of over 100 ft. The arches are supported by columns spaced approximately 7 ft apart, the same distance at which the columns of the twin WTC towers were spaced. The spaces between the columns and the gap between the arches are covered in glass, which allows natural light to illuminate the 90,000-sq.-ft main hall, creating a unique and dramatic space. The “wings” of the dove consist of variable-length rafters that extend from the arches to form a roof-like structure; the longest rafter stretches 197 ft. The entire structure uses a total of 11,500 tons of structural steel.

A sequential erection scheme, rather than shoring, allowed the geometry and load paths to be measured throughout construction. This type of erection is similar to what is used for bridges and allowed adjustments to the geometry as the structure was erected. Having this ongoing adjustment feedback enabled the team to keep the target geometry of the complex structure on track. Starting at either end of the building from the abutments, a steel column was lifted into place by crane, and then an arch segment was installed on top of this and affixed to the previous arch piece until the arches met at the high point in the middle.

Essential to the segmental erection process was the staged construction computer analysis model created for the project. The erection tolerances for the structural steel were exceedingly tight. In order to allow the glazing to fit properly, the steel in the arch and the columns had to be within 1/2 in. of the theoretical design location. The project team used the model to determine the cambered shape of each individual steel segment, the stresses in the structure and the position of the geometry control points during each stage of the erection. With the installation of each new steel segment, the project team was able to know whether the geometry of the building had remained on track or if it would need to be slightly altered before construction could progress. From this model, the team used a geometry control spreadsheet that took the data from the model and simplified it so that the surveyors were able to gain target coordinates for the steel segments as they were being maneuvered into place.

In terms of connections, the project team was able to eliminate most field welding for the arches by replacing welded splices with bolted ones. Due to the thick arch plates and the need to hide the bolted splices inside the arches rather than place them visibly on the exterior, the size and number of bolts was very large. Approximately 100 1 1/2-in. A490 bolts were employed for each arch splice, which reduced the time needed to fully connect the arch pieces to only two days each. Not only did this drastically reduce the erection schedule, but the bolt approach also made it significantly easier for the contractor to install the various segments and achieve the desired geometry for the arches.

**Owner**

Port Authority of NY and NJ

**General Contractor**

Skanska

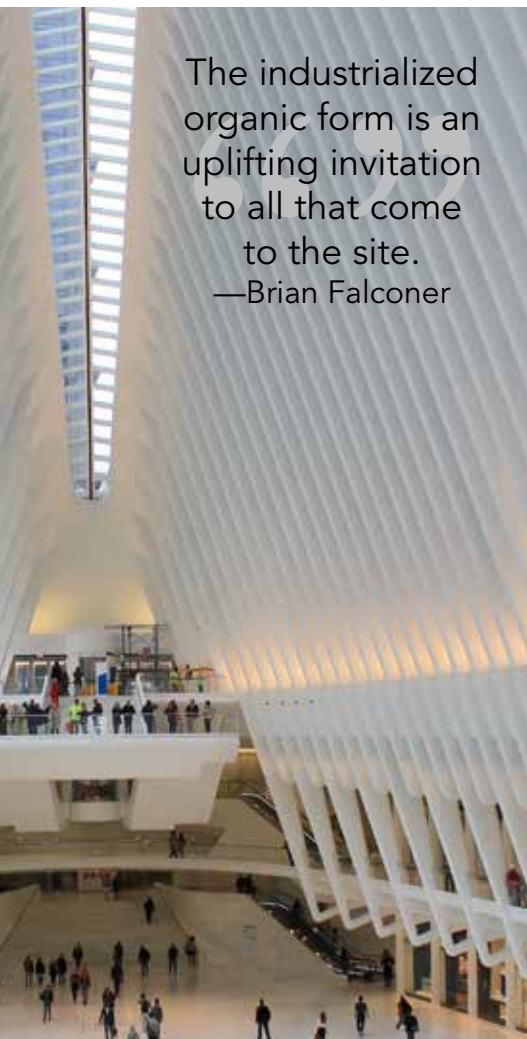
**Engineer of Record and Architect of Record**

The Downtown Design Partnership, an STV/AECOM joint venture, in association with Parsons Transportation Group

**Design Architect and Structural Engineer**

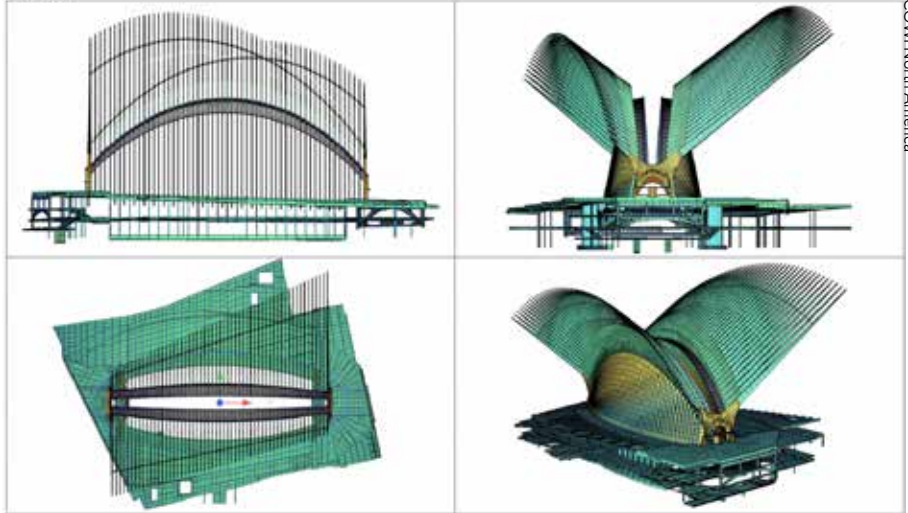
Santiago Calatrava





The industrialized organic form is an uplifting invitation to all that come to the site.  
—Brian Falconer

Critical Stage #6



COMI North America

Skanska USA



**OVER \$75 MILLION | MERIT AWARD**  
**111 Main, Salt Lake City**

**111 MAIN BRINGS** a half-million sq. ft of Class A office space to downtown Salt Lake City—topped with a rather impressive hat.

The 387-ft-tall building consists of 24 stories above grade, a penthouse level and one basement level. But unlike a typical office tower, it also had to account for the new five-story Eccles Theater next door—next door meaning partially underneath. 111 Main’s southern property line was defined by an air rights agreement with the property owner of the theater that allows the tower to extend above the theater starting at Level 5. To accommodate the theater, 111 Main required a structural system that did not extend columns below the fifth level on the south side, allowing design development and construction of the two projects to be undertaken concurrently, which satisfied the objectives of both.

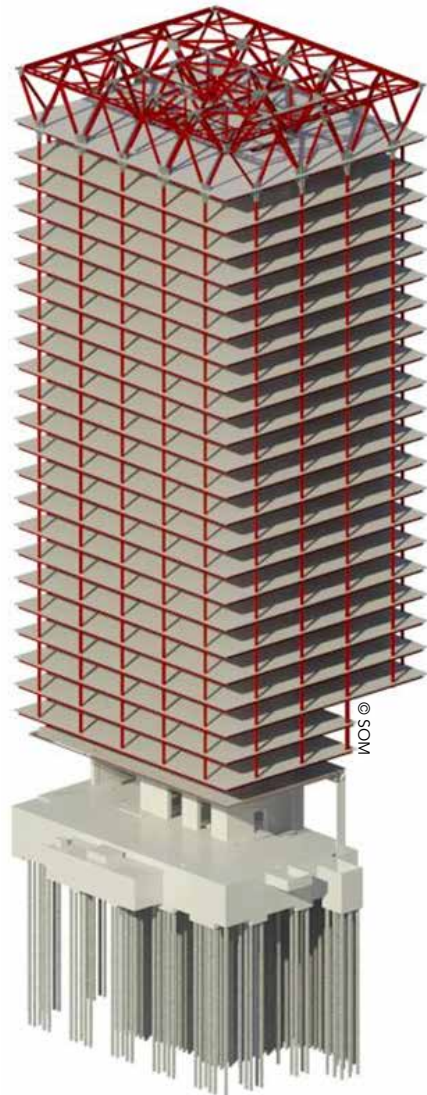
Structural engineer and architect Skidmore, Owings and Merrill (SOM) designed the penthouse level to be comprised of a balanced two-way 3D steel hat truss system that supports the office tower’s 18 perimeter columns in an integrated load-balanced structure. Measuring 28 ft, 1.5 in. deep and weighing 1,870 tons, the hat truss extends 40 ft to 45 ft from the core walls. The building is tuned with longer clear spans for the 20 suspended south-side levels to balance the load of the shorter spans in the 23 suspended north-side levels.

The central reinforced concrete core walls provide the tower’s only connection to its complex foundation and resist all gravity loads, as well as wind and seismic vertical and lateral loads. Conventional long-span, composite-steel floor framing construction connects the central core walls to the perimeter steel frame and suspended columns, providing open office spaces free of interior columns. The truss solution also allowed the project teams for 111 Main and the Eccles Theater to work independently and achieve their unified architectural goals, and minimal structural and schedule coordination between the two project teams was required during the design and construction stages of both buildings.

Located in a region of high seismicity (near the active Wasatch Fault Zone) the building was designed to withstand not only ground motions based on actual earthquakes that might occur on the site, but also an extreme earthquake that could happen once every 2,500 years. Few if any buildings in Utah have been designed to withstand this level of rigor. This is where six structural steel bearings, supplied by Earthquake Protection Systems in Vallejo, Calif.—each consisting of an articulated slider, a steel concave plate and a steel housing plate—came in. A sliding spherical surface in each bearing is intended to serve as a “pinned” connection at the interface of the steel hat truss and the concrete core wall below to minimize any



© City Creek Reserve



© SOM



© Cesar Rubio



© Paul Richer



© Cesar Rubio

unfavorable twisting effects caused by seismic and gravity deflection, as well as changes in temperature, of the exposed hat truss. To provide sufficient horizontal constraint to the truss and avoid excessive sliding of the structural bearings, seven W14x730 shear keys extend down from the bottom truss chords to pockets at the top of the core walls. Complete joint penetration (CJP) moment connections were provided between the truss bottom chords and the shear keys. Below the core walls, a deep foundation system comprised of steel H-piles extends more than 100 ft below grade. A total of 373 HP14x89 and HP14x117 piles were used.

To meet the demanding construction schedule, the construction and engineering design-assist team—which included SOM, general contractor Okland Construction Company, SME Steel Contractors, Hassett Engineering and exterior wall subcontractor Steel Encounters—developed a sequential, bottom-up staged construction scheme. This scheme comprised staged temporary shoring involving a saddle cable system that was anchored through the core walls north-to-south at Level 5, temporary hydraulic jacks and additional steel bracing. This temporary shoring system supported the seven interrupted columns in the south side of the building over the Eccles Theater while both projects were constructed simultaneously. The remaining 11 columns were shored by temporary hydraulic jacks at Level 1. Upon completion of the roof hat truss assembly, a jacking process transferred the compressive loads from the temporary shoring columns to the hat truss system during a single 12-hour period, reversing

the stress in the perimeter columns from compression to tension while three-quarters of the building's exterior was in place. The perimeter columns and tips of the hat truss were carefully positioned up during the temporary shoring. After the load was transferred, all columns and truss tips moved down as intended into the flat, permanent design condition.

For more on 111 Main, see “Hanging Out In Salt Lake City” at [www.modernsteel.com/111main](http://www.modernsteel.com/111main).

**Owner**

City Creek Reserve, Inc., Salt Lake City

**General Contractor**

Okland Construction Co., Salt Lake City

**Architects**

Skidmore, Owings and Merrill, LLP, San Francisco  
VCBO Architecture, Salt Lake City

**Structural Engineers**

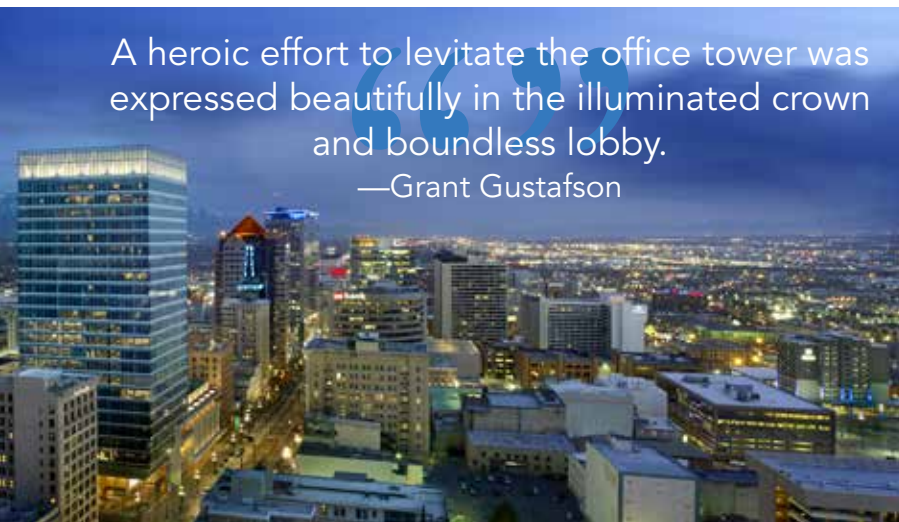
Skidmore, Owings and Merrill, LLP  
Dunn Associates, Inc., Salt Lake City

**Erection Engineer**

Hassett Engineering, Inc., Castro Valley, Calif.

**Steel Fabricator, Detailer and Erector**

SME Steel Contractors, Inc., West Jordan, Utah



A heroic effort to levitate the office tower was expressed beautifully in the illuminated crown and boundless lobby.  
—Grant Gustafson



**OVER \$75 MILLION | MERIT AWARD**

**U.S. Bank Stadium, Minneapolis**

**U.S. BANK STADIUM** in Minneapolis is reminiscent of a Viking longship—though at 1.7 million sq. ft and able to seat more than 66,000, it is a bit larger.

The new home of the Minnesota Vikings, which just hosted Super Bowl LII, the stadium is defined by its complex geometry, innovative transparent ethylene-tetra-fluoro-ethylene (ETFE) roof, iconic pivoting doors and panoramic-view concourses. Although operable walls exist in a few other stadiums, the five 55-ft-wide by 75- to 95-ft-high, curtain wall-clad structural steel hydraulic mechanized pivoting wall panels at U.S. Bank Stadium are unprecedented in both scale and operation.

The structural steel design and use of materials and technology transforms an enclosed facility into a light-filled, dynamic space, as the transparent roof and moveable panels admit abundant natural light, creating an outdoor feel while protecting occupants from the elements. Comprising more than 240,000 sq. ft, with some panels measuring more than 420 ft in length, the three-layer Teflon ETFE polymer film, air-pressure-stabilized pillow system covering the south-sloping roof of the stadium is the largest transparent ETFE roof in North America. The lightweight ETFE allowed the structural engineers to provide primary roof support with a single 970-ft steel ridge truss, resulting in cost savings and a striking visual lightness.

The final roof geometry was formed and optimized through highly detailed collaboration between the design team and the wind consultant. The orchestration of such a large and complex structure required the use of Rhino software with the parametric plug-in Grasshopper. The parametric model created via Grasshopper allowed for the exploration of key design issues and solutions while considering consequent effects to the entire structure. The design team used Grasshopper to optimize the roof pitch and slope to minimize snow accumulation and reduce roof snow loads, a crucial parameter when considering the loading of the structure. As a result, climate consultant RWDI rendered a nearly 25% reduction in roof snow loads, equating to more than \$8 million in roof steel cost savings, and one of the lightest structural steel NFL stadium roofs.

The engineering and construction engineering teams collaborated closely with Mortenson Construction, architect HKS, steel fabricator LeJeune Steel and steel erector Danny's Construction to design, model, detail, procure, fabricate and erect the long-span steel roof.

Paramount to transferring design information to the construction team was the integration of connection design during the structural design pro-



LeJeune Steel



Joe Aker

When does a roof mimic the hull of a Viking ship? When it is the sun-drenched roof of the Minnesota Vikings' stadium!  
—Brian Falconer



Joe Aker



Minnesota Vikings



HKS



HKS

cess. Thornton Tomasetti's Advanced Project Delivery (APD) approach employs specialized connection design engineers and steel detailers working side by side with the structural design team to conceptualize the connections early in the design phase once member geometry is set and initial force magnitudes are available. These early connection concepts were formulated with fabrication and erection considerations.

Transfer of connection design information was validated for constructability by Thornton Tomasetti's modeling of the connections in Tekla Structures. Weekly steel desktop coordination meetings were held between LeJeune Steel, Danny's Construction, Mortenson, steel detailer LTC and Thornton Tomasetti, where the modeled connections and progress were shared and reviewed with all parties. Coordination items were addressed in real time through the use of a shared live Tekla model using a cloud-based Panzura system that allowed Thornton Tomasetti's engineers to work side by side with LTC. The APD approach facilitated the transfer of information, led to a greater understanding and visualization of the project requirements and reduced RFIs considerably while ensuring that the project budget and schedule would be maintained. This coordination allowed for an expedient shop drawing review process, enabling the design team, fabricator and erector to focus on issues pertaining to erection plans, possible connection modifications and the construction time line prior to the release of shop drawings, thus enabling proactive information review.

The integrated proactive steel delivery process resulted in a collaborative cloud-based long-span steel roof design, streamlined submittal review process, timely fabrication, swift erection and eventual delivery of a 11,100-ton steel project nearly one month ahead of schedule.

**Owner**

Minnesota Sports Facility Authority, Minneapolis

**General Contractor**

Mortenson Construction, Minneapolis

**Architect**

HKS, Inc., Dallas

**Structural Engineer**


Thornton Tomasetti, Dallas

**Steel Team**

**Fabricator**

LeJeune Steel Co., Minneapolis 

**Erector**

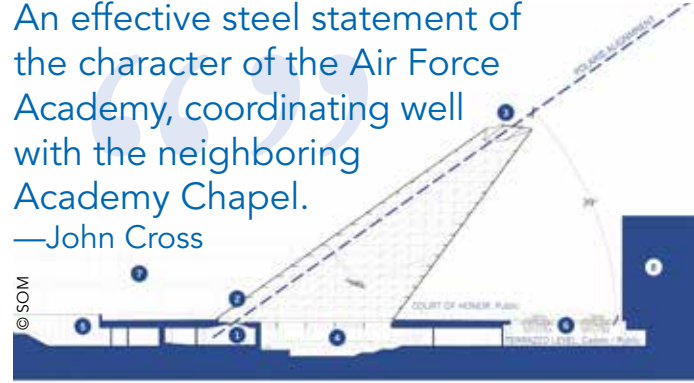
Danny's Construction Co., Shakopee, Minn. 

**Detailer**

LTC, Inc., West Salem, Wis. 



An effective steel statement of the character of the Air Force Academy, coordinating well with the neighboring Academy Chapel.  
—John Cross



North-South Section  
1. Honor Board Room | 2. Honor Board Room Skylight | 3. Skylight Drive | 4. The Pines | 5. Communit Bar | 6. North Entry Courtyard  
7. Terrace Hall (Administration Building) | 8. West Hall (Barracks Building)



© SOM

Courtesy SOM © Magda Bernat

**\$15 MILLION TO \$75 MILLION | NATIONAL AWARD**

**USAFA Center for Character and Leadership Development, Colorado Springs, Colo.**

**THE UNITED STATES** Air Force Academy’s Center for Character and Leadership Development (CCLD) supports the school’s mission to integrate character and leadership development into all aspects of the Cadet experience—while also serving as a think tank for leadership and character development initiatives nationwide.

The Skidmore, Owings and Merrill-designed CCLD represents an important and symbolic addition to the Academy’s campus, also designed by SOM, in 1954, and designated a National Historic Landmark District in 2004. As the first building constructed in the Cadet Area since the 1990s, the CCLD creates a significant architectural counterpoint to the Academy’s iconic Cadet Chapel.

The CCLD features a dramatic cantilevering 105-ft-long skylight, a design element that establishes a bold presence on the campus while bringing ample natural light into the building. With its complete integration of architecture and structural engineering, dynamic form and machine-like precision, the skylight is fluid yet disciplined. Its structure consists of diagonal steel plates composed in a triangular grid and precisely calibrated to resist lateral forces due to wind loading. The architecturally exposed structural steel (AESS) is devoid of embellishment or ornamentation, and its sleek connections are cohesive with the aesthetics of the structure. This glass-

enclosed structure, shaped like a plane’s tail fin, aligns precisely with the North Star, Polaris, signifying the Academy’s mission to develop leaders of character. By aligning this new center for community and collaboration under Polaris, the design creates a meaningful architectural interpretation of the Academy’s aspirations.

The skylight structure simultaneously reflects and responds to its context. At the Court of Honor Level, marble pavers mark the 28-ft grid of the campus, and the CCLD continues this pattern to the base of the skylight where the square grid of the campus transforms to its triangular geometry. The well-defined, crisp edges of the form are a hallmark of structural steel, requiring no additional cladding, and the structural design sought to maximize the material characteristics of steel: weldability, ductility, durability and constructability. While the rigidity of the campus layout is reflected in the skylight, it does not entirely define it. Like the Cadet Chapel before it, the skylight respects the right-angle geometry of the Academy but distinguishes itself as a campus landmark with its own character. Below the Court of Honor, AESS braced frames carrying the skylight are spaced 14 ft apart. The buttressed forum is afforded an exceptional amount of open, column-free space, allowing a variety of configurations for programming and audience



layout. The compact shape of the built-up steel frames further enhances the transparency of the forum space and visually extends it into the adjacent breakout rooms.

The skylight's structure consists of horizontal and diagonal structural steel plates, intentionally landing every 7 ft, composed in a triangular grid and calibrated to resist the lateral forces produced by the wind. This calibration was achieved by considering the deflected shape of the skylight geometry under an inward pressure. When combined with the original geometry, this deflected shape became the inner boundary of the skylight's steel plates, providing a varying depth across each face. The product is a triangulated system using plates of varying depth and creates a normalized stiffness profile across each face to provide a stable base for attaching the glazed cladding units. The system forms the outer skin of the skylight and allows for the optimized glass joint dimension. Through the use of an iterative analysis and design method, structural steel was added only at locations where it was required by the performance of the structure, resulting in maximized material efficiency. Analysis of the skylight also included consideration of both global and local buckling analyses for geometric and material non-linearity, as well as a check of stresses in the plate members to highlight the flow of loads through the structure and areas of stress concentration.

Constructability played a central role in the design and detailing of the skylight. As such, a number of decisions were made throughout the design process to rationalize the geometry to ensure the building could be constructed easily. Because the skylight is com-

posed of AESS, the design team sought to minimize the number of connections that must be made in the field. To accomplish this, the assembly was designed as a series of "stacked trusses." Each truss was constructed on the ground, where the required level of finish was more easily attained, before being lifted into place as a whole. The design of the considered the visual impact of the connections to preserve the seamless design aesthetic while maintaining bolted connections for easy erection in the field. Through the use of planar structural steel plate elements, the stacked truss system and standard connection types, the resulting design was a completely unique form, yet one that required no proprietary connections or specialty fabrication.

Having earned LEED-NC Gold certification, the CCLD sets a new standard for green technology and building practices on the Academy's campus. Integrated building systems influenced all aspects of the building's design, construction and operation, which allowed SOM's design for the CCLD to create a distinct and contemporary icon for the U.S. Air Force Academy in the 21st century, while also respecting the discipline and rigor of the original campus plan.

**Owner**

United States Air Force Academy

**General Contractor**

ECC, Burlingame, Calif.

**Architect and Structural Engineer**

Skidmore, Owings and Merrill, LLP, New York



Nigel Young, Foster + Partners



Nigel Young, Foster + Partners



Foster + Partners



Foster + Partners



Foster + Partners



Nigel Young, Foster + Partners

MAY 2018



Nigel Young, Foster + Partners

## \$15 MILLION TO \$75 MILLION | MERIT AWARD Apple Union Square, San Francisco

**APPLE STORES ARE WELL KNOWN** for bringing elegant, transparent design to dense urban landscapes.

On of the newest locations, at the northeast corner of Union Square in downtown San Francisco, involved major alterations to an existing structure, with the addition of a new structure over a functioning below-ground ballroom and loading dock of a Hyatt hotel.

The project comprises three separate volumes totaling nearly 24,000 sq. ft: the Store, the Bar Building and the Plaza. The Store connects Union Square on the south side to the quiet, contemplative Plaza on the north. The Bar Building flanks the Store to the west and forms the backdrop to the Plaza with a green wall and water features including the historic Asawa Fountain.

The store's design brings enhanced levels of transparency, openness and civic generosity. The sliding glass doors allow the Store to connect the existing square to the Plaza, creating a sense of urban permeability. As a foil to the lively activities of Union Square, the new art-filled plaza serves as a tranquil garden of contemplation, creating a serene gathering place for the community. The sliding glass doors are also a part of a natural ventilation system that allows the store to draw in fresh air before it is expelled through the roof. The roof structure is designed and integrated to support 130 photovoltaic panels that supply the building with renewable energy.

The Store is a rectilinear volume measuring 105 ft by 83 ft in plan and approximately 46 ft tall, with an occupied area of nearly 11,000 sq. ft. The unique features of the Store—including the tall sliding doors, a bridge-scale transfer truss, a grand cantilevered floor, a voluminous interior space and ductile seismic bracing—were all made possible because of structural steel, with the majority of the framing system being constructed of wide-flange shapes, hollow structural sections (HSS) and built-up sections. The sliding steel-and-glass doors of the south façade are some of the largest ever built, each measuring 42 ft tall by 20.5 ft wide. The north façade features similar doors, approximately 26 ft tall. The generous interior volume is divided horizontally by a dramatic cantilevered floor that extends 37 ft beyond the support to create a 16-ft-high piano nobile that tapers to less than one foot at the tip.

Special concentrically braced frames (SCBFs) comprise the seismic lateral force-resisting system in both directions. The braced spine is built on a substantial steel transfer truss that spans over a functioning below-ground ballroom. The second-floor cantilever is constructed of tapered built-up steel beams and incorporates tuned mass dampers to reduce the vibration response. Lightweight tapered steel trusses support the roof and enclose the generous interior volume. Structural steel brought strength and lightness to the superstructure, which was designed to avoid loading the existing structural elements, as well as maximum reliability and redundancy in this high-seismic zone. Steel also allowed the structure to be tightly integrated with the architectural finishes and services within the constraints of the tapering floor and roof zones of the Store.

The Bar Building is a four-story rectangular structure to the west of the Store and measures 176 ft by 21 ft. It is the remnant structure of the 1970s Hyatt House (aka the Levi's building) a triangular building that was demolished to make way for the new Store. The complexity of the rectangular Bar Building is masked by its simple form. Numerous steel and concrete transfer structures were constructed below ground while maintaining the continued function of the basement ballroom and hotel loading dock. The use of steel roof bracing to strengthen the existing roof diaphragm to resist seismic loads helped preserve the existing structure, where other structural options would have been excessively heavy and required more extensive demolition.

Apple Union Square was a major structural engineering achievement, combining simultaneous requirements for numerous challenging structural features, tight integration with architecture and services, complex existing conditions and high-seismic detailing—not to mention supersized sliding glass doors. Seismic design principles permeated every aspect of design, and the engineers carefully located new structural elements in ways that protected and integrated the existing structure while maintaining the architecture as the centerpiece of the project. The project provides an extraordinary new mixture of high design, commerce and community in the center of San Francisco, revitalizing and reconnecting visitors and residents to a previously little-used public space.

### General Contractor

Ledcor Construction, Henderson, Nev.

### Architect

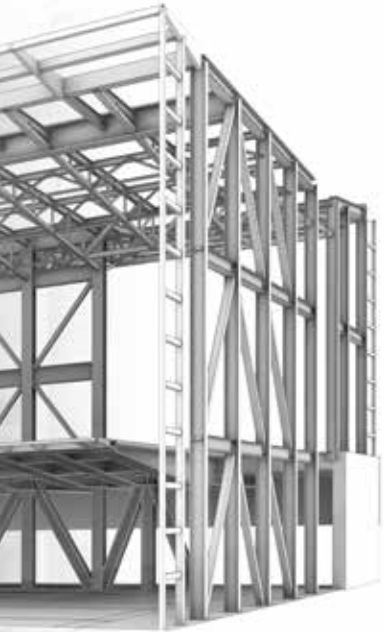
Foster + Partners, London

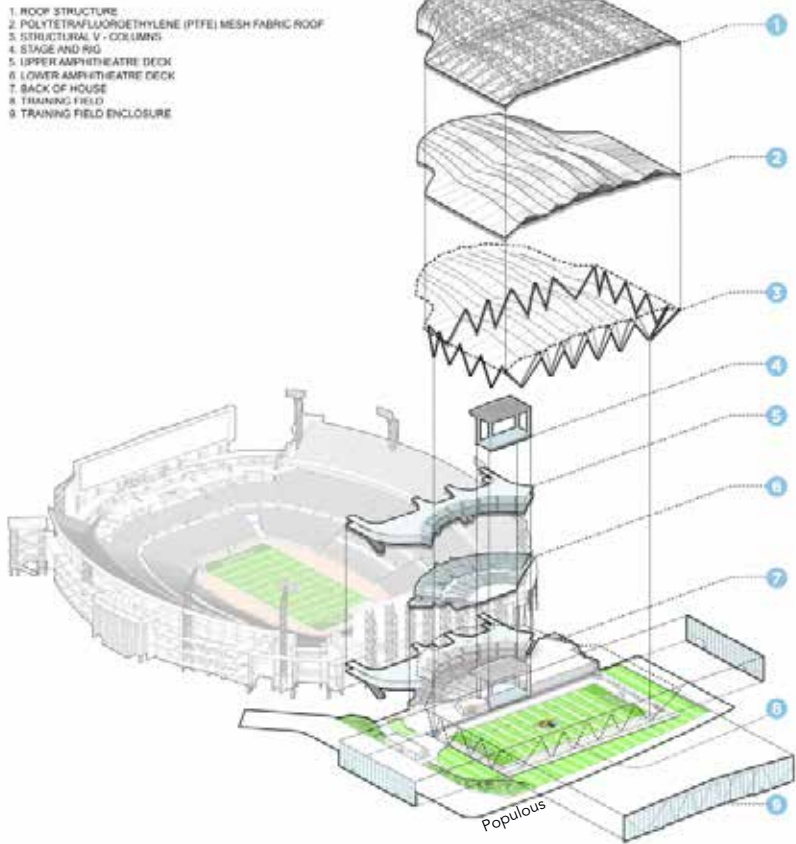
### Structural Engineers

Foster + Partners

Simpson Gumpertz and Heger, San Francisco

One would never guess that beneath the clean, thin lines of this project, there is a sizeable structure that makes the building possible. —Lynda Leigh





JAGUARS AMPHITHEATER AND COVERED FLEX FIELD

**\$15 MILLION TO \$75 MILLION | MERIT AWARD**  
**Daily's Place, Jacksonville, Fla.**

**PROFESSIONAL SPORTS TEAM OWNERS** of all types have long looked for ways to monetize their stadiums beyond their respective seasons.

TIAA Bank Field, home to the NFL's Jacksonville Jaguars, has taken things even further with the addition of an adjacent new, all-weather team training facility that also serves the dual purpose of increasing the vibrancy of downtown Jacksonville.

Daily's Place, named for a local convenience store chain, is a first-of-its-kind facility: a 5,500-seat concert venue that connects a new, 94,000-sq.-ft indoor football training facility to TIAA Bank Field (recently renamed from EverBank Stadium). Both new spaces are covered by a fabric roof that is elegantly suspended from a sinuous exposed steel roof structure.

Architect Populous' design was inspired by Jacksonville's distinctive array of steel truss bridges over the St. John's River, resulting in a 450-ft-span roof form that seamlessly blends structure and architecture to cover both the practice field and performance venue. Collaborating with structural and enclosure engineer Walter P Moore from the outset, the design team developed an integrated structure that features exposed articulated steel trusses atop a single-layer membrane hung below. The exposed trusses architecturally connect the venue to the adjacent stadium scoreboard structure and provide a visual nod to the nearby Hart Bridge.

Exposed V-columns around the perimeter serve as vertical load-bearing members while economically resisting hurricane-force winds. Massive, 50-ft-tall rolling doors make the spaces

flexible, enabling the facility to host a wide variety of events including conventions, festivals and the NFL draft. The cost-efficient marriage of exposed steel with a specialized, shimmering fabric membrane allows the structure to appear opaque during the day—protecting Jaguars' practices from the prying eyes of competitors—and come translucently alive at night via distinct lighting from within.

Key to the project's success was a fully integrated design approach that simultaneously developed the architecture, structure and membrane designs. Construction manager Hunt-Danis engaged steel fabricator Banker Steel and the membrane system supplier early to collaborate with the design team. One significant concern was water management at the attachments of the single-layer membrane roof beneath the roof trusses. Working closely with the membrane supplier, Walter P Moore developed innovative, reliable attachments at the truss nodes, thereby mitigating concerns about leaking at these key points. The result was a series of beautiful exposed trusses complemented by a diaphanous, single-layer (rather than a more expensive double-layer) membrane.

The schedule was driven by a series of concerts scheduled for Memorial Day weekend of 2017, leaving only 13 months from the end of design development to opening day. To achieve such an accelerated pace, the integrated project team implemented a fully digital delivery process that eliminated the sequential handoffs of documents between design team, construction manager and subcontractors that tend to slow traditional processes. A central information



Hunt-Danis



Root Photography



Hunt-Danis



Root Photography

Simple, disciplined elegance emphasizing the joys of a tent structure, along with curving roof shapes and the relief of openness. —Grant Gustafson

database (CID) created from the architect's Rhino model was crucial to this process. Every participant drew data from the CID, which defined the complex work point geometry for the entire project, feeding structural and documentation software platforms including Rhino, Revit, SAP 2000 and Tekla to seamlessly develop the raw architectural form into a fully connected Tekla model that was delivered to Banker. By faithfully maintaining the CID throughout the project, the team could absorb ongoing design refinements and explore value engineering options without slowing down or introducing coordination errors. Hunt-Danis estimated that this overlapping and interoperable digital process shortened the project time frame by 15% without compromising quality or cost.

The digital delivery also enabled real-time tracking of steel tonnage as the design developed, helping keep the project tightly aligned with its budget of \$60 million. To further speed the process, the design team's fully connected Tekla model included all needed connection information including bolts, shims and welds, eliminating another step in the procurement process that the schedule could not accommodate. The result of this more comprehensive approach was lightning-fast completion without the additional costs that too often accompany project acceleration. Total steel change orders amounted to less than 0.2% of the contract amount for the primary steel.

Thanks to innovative design and delivery, Daily's Place opened on time and to rave reviews for a Dave Matthews concert and hosted

27 events over its first four months leading into football season. The elegant steel structure is distinctively lit at night, creating a new architectural landmark for Jacksonville—and perhaps most importantly, the new venue has helped revitalize the downtown area while making TIAA Bank Stadium a much more vibrant civic destination for Jaguar fans and the public.

#### Owners

City of Jacksonville  
Jacksonville Jaguars, LLC

#### General Contractor

Hunt-Danis, a Joint Venture, Indianapolis and Jacksonville

#### Architect

Populous, Kansas City

#### Structural Engineer and Connection Designer

Walter P Moore, Kansas City

#### Steel Team



##### Fabricator

Banker Steel Company, Lynchburg, Va. 

##### Erector

Midwest Steel, Inc., Detroit 

##### Detailers

BDS Vircon, Brisbane, Australia   
LTC, Inc., West Salem, Wis. 



**\$15 MILLION TO \$75 MILLION | MERIT AWARD**

**UC Davis Jan Shrem and Maria Manetti Shrem Museum of Art, Davis, Calif.**

**THE JAN SHREM** and Maria Manetti Shrem Museum of Art at the University of California, Davis, sits at the edge of a frontier of sorts—on the edge of campus and town, across a major Interstate from farmland.

The project is visually defined and covered by a 50,000-sq.-ft undulating canopy over the building and the majority of the remaining site. The varying angles and porosity of the canopy infill members filter and reflect sunlight, creating an experience that changes throughout the day and from season to season.

The canopy is supported by round HSS sections of varying diameters ranging dramatically in height from 15 ft to 35 ft, all supporting HSS14×10 girders and beams. They in turn support triangular, perforated aluminum infill beams of varying spacing, orientations and perforations. The canopy columns are each founded on a concrete drilled pier, creating a “flag pole” system of cantilevered columns. The canopy is tied to the building pavilions, so lateral forces are shared by the cantilever columns and the lateral system—made of buckling-restrained braced frames (BRBFs)—and the canopy girders function as seismic collectors.

The museum program itself includes a set of irregularly shaped one-story and two-story pavilions providing gallery, studio, community, administrative and service space—all linked together by a low roof and the canopy above. Framing for the pavilions consists of concrete fill on metal deck diaphragms supported by steel beams and girders, with steel columns bearing on spread footings and grade beams. Steel framing efficiently supported the long-span roofs over large galleries and could be manipulated to address complicated skewed conditions, sloping and intersecting roofs and various cantilevered regions.

*For more on the UC Davis Shrem Museum, see “Above All, Art” at [www.modernsteel.com/sbrem](http://www.modernsteel.com/sbrem).*

**Owner**

University of California, Davis

**General Contractor**

Whiting-Turner Contracting Co., Folsom, Calif.

**Architects**

Bohlin Cywinski Jackson, San Francisco  
SO-IL Office, Ltd., Brooklyn, N.Y.

**Structural Engineer**


Rutherford + Chekene, San Francisco

**Canopy Infill Beam Engineer**


Front, Inc., Brooklyn, N.Y.

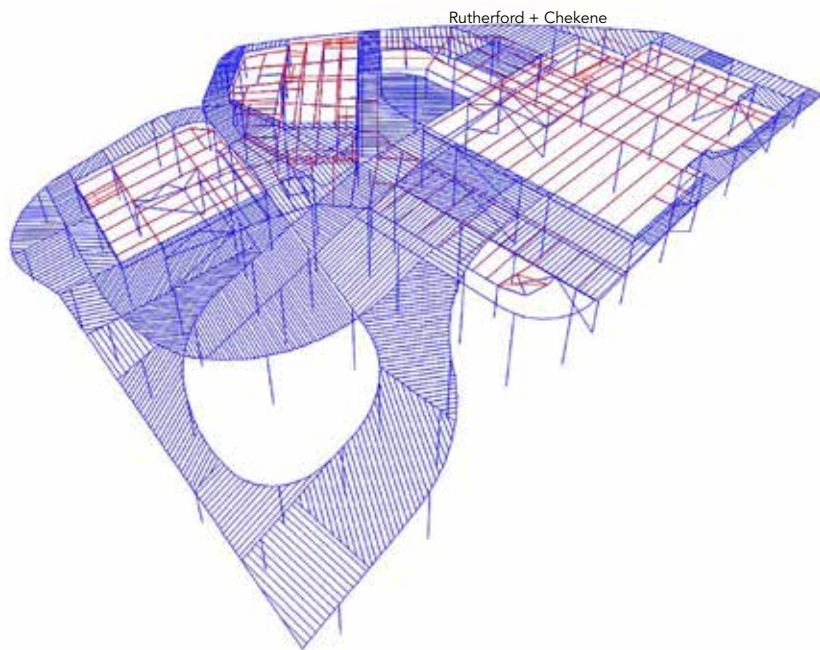
**Steel Team**

**Fabricator, Erector and Detailer**

Olson and Co. Steel, Inc., San Leandro, Calif. 

**Bender Roller**

Albina Co., Inc., Tualatin, Ore. 





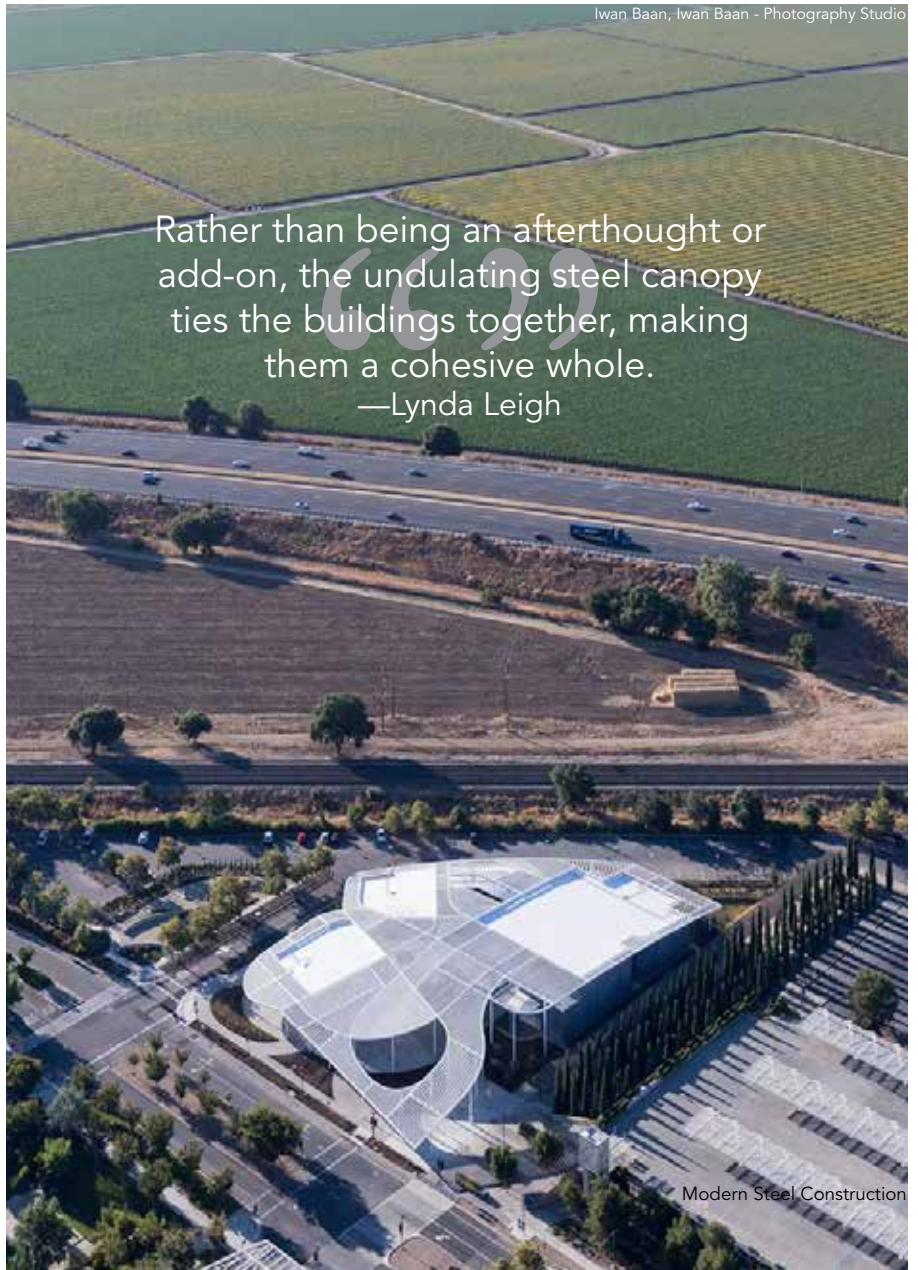
Iwan Baan, Iwan Baan - Photography Studio



Ryan Keerns, Bohlin Cywinski Jackson



Bret Lizundia, Rutherford + Clekeme



Iwan Baan, Iwan Baan - Photography Studio

Rather than being an afterthought or add-on, the undulating steel canopy ties the buildings together, making them a cohesive whole.  
—Lynda Leigh



Iwan Baan, Iwan Baan - Photography Studio

**UNDER \$15 MILLION | NATIONAL AWARD**

## North Transfer Station Rebuild, Tipping and Transfer Building, Seattle

### SCENIC VIEWS AND solar-powered?

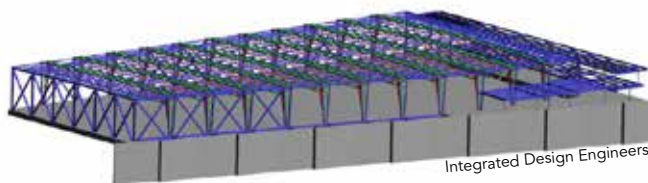
Probably not two of the top phrases that come to mind when contemplating waste facilities. But both are indeed applicable to Seattle's renovated North Transfer Station, which processes 750 tons of waste and recyclables on-site every day.

The new 67,000-sq.-ft Tipping and Transfer Building, built to modernize the original 1960s facility, is topped with a 150-kW solar array and green space that covers 80% of the roof, and is located next to a residential neighborhood at the edge of Lake Union.

In addition to being somewhat boxed in against the water, the building faced other spatial challenges as well. The lower-level southwest corner had to be clear of columns and walls to allow trucks access after driving down the ramp from the street, and the upper level of the building had to be column-free for its full 200-ft span. For the first issue, the engineering team designed a 50-ft cantilever truss and a 120-ft main transfer truss system that

supports the weight of the entire building at its southwest corner—as solution known as the “floating corner.” The main transfer truss at the south face is supported by a double-W30 beam embedded in the concrete slab on the east and a full-story cantilever truss on the west. The full-story truss depth was selected to optimize the structural weight and facilitate stabilization of the top and bottom chords.

As for the 200-ft span, the design needed to achieve this without exceeding a roof structure depth of 7 ft (a span-to-depth ratio of L/28) as nearby residents weren't willing to give up their views of Lake Union. The solution came in the form of a primary lateral system of tri-chorded steel trusses, which provided greater load capacity and stability and were simpler to erect than a deep girder system—while also allowing daylighting to penetrate deeper into the building. To achieve the relatively low truss depth, the tri-chorded roof truss system uses ASTM A1085 hollow structural



sections (HSS)—90 tons—which enabled the team to reduce the size of the bottom chord HSS and create a ductile trussed frame to resist seismic loading in the north-south direction. Each of the 11 tri-chorded roof trusses is composed of two wide-flange top chords that are 10 in. deep, located 6 ft apart parallel to each other, with a ridge at mid-span sloping 2% downwards on both ends.

Due to the structural system’s complexity, engineer Integrated Design Engineers shared its 3D model and created mock-ups with fabricator Fought and Company, which accelerated the fabrication process significantly. In addition, Fought test-assembled the trusses in its shop—as is commonly done in bridge fabrication—which ensured perfect fit-up on-site.

*For more on the North Transfer Station, see “Waste Not” at [www.modernsteel.com/northtransfer](http://www.modernsteel.com/northtransfer).*

**Owner**

Seattle Public Utilities

**General Contractor**

Lydig Construction, Bellevue, Wash.

**Architect**


Mahlum Architects, Inc., Seattle

**Structural Engineers**


Integrated Design Engineers LLC, Seattle  
CDM Smith Inc., Walnut Creek, Calif.

**Steel Team**

**Fabricator**

Fought and Company, Inc. Tigard, Ore. 

**Detailer**

Steel Systems Engineering, Inc. Sherman Oaks, Calif. 



**UNDER \$15 MILLION | MERIT AWARD**

**Riggs CAT Headquarters,  
Little Rock, Ark.**

**RIGGS CAT HAS** some heavy lifting to do.

The company employs more than 400 people in eight different facilities throughout Arkansas as the state's only Caterpillar dealer. It recently renovated and expanded its Little Rock headquarters location, replacing a 50-year-old building with a modern, light-filled steel structure. Existing warehouses and shops were demolished, and their footprints became lay-down space for construction that could not impede existing service and equipment yard operations.

Framed using 163 tons of structural steel, the new building pays homage to the adjacent 1950s warehouse (which was renovated into a training center) and was inspired by CAT equipment itself, from abstract arm booms and truck beds to grader blades and wheel tracks dug into the earth. The roof lifts to the west, facing the existing site entrance, new display court and repurposed training center.

Transparency, thanks to extensive glazing, defines the design, with HSS5x5 being used to support the exterior glass. Inside, the primary stair landing sits in a glowing red box that cantilevers under the main porch and acts as a beacon from the nearby Interstate. Clerestories at the second-floor executive offices flood the central spaces with daylighting, and the lobby is 100% naturally lit during the day. A large "floating" meeting room cantilevers over the reception area thanks to simple welded steel connections and diagonal bracing.

The light, exposed-framing characteristic of the new building was inspired by the exposed steel and masonry of the warehouse-turned-training center. As the original building was not properly braced—no moment frames or diagonal bracing were present and original drawings were unavailable—the design team incorporated new exposed steel bracing that doubles as the workers' entrance from the yard.

*For more on the Riggs CAT headquarters, see "Matching Metal" at [www.modernsteel.com/riggs](http://www.modernsteel.com/riggs).*

**Owner**

J.A. Riggs Tractor Co., Little Rock, Ark.

**General Contractor**

Baldwin and Shell Construction, Little Rock

**Architect**

Polk Stanley Wilcox Architects, Little Rock

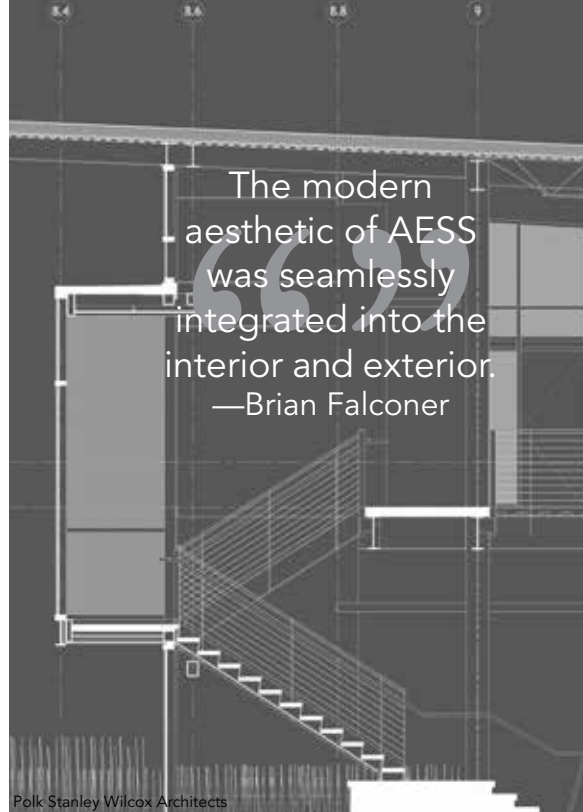
**Structural Engineer**

Bernhard TME, Little Rock

**Steel Detailer**

Prodraft, Inc., Chesapeake, Va. 

MAY 2018





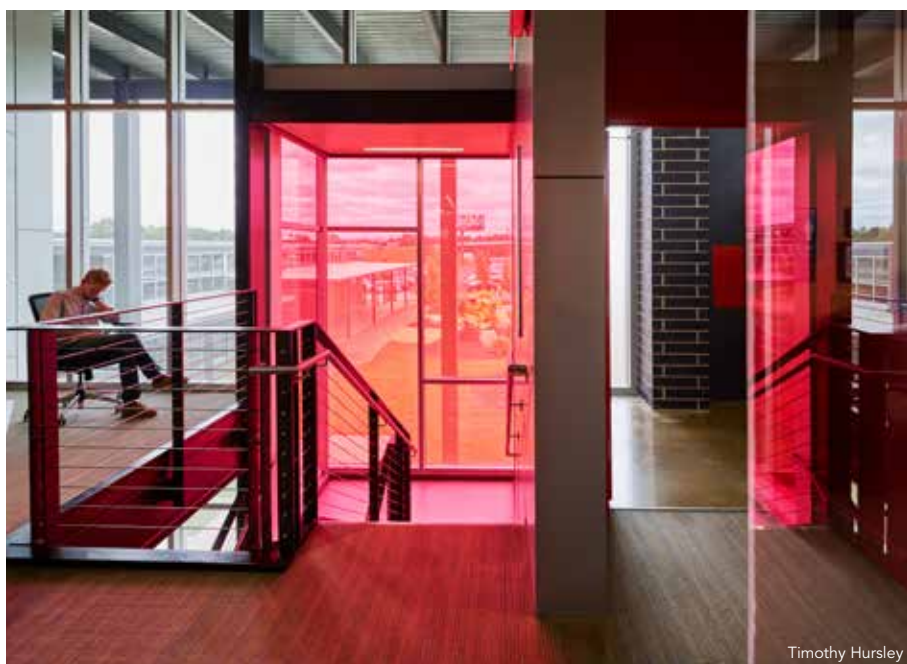
Timothy Hursley



Timothy Hursley



Timothy Hursley



Timothy Hursley



Timothy Hursley



Timothy Hursley



Hillsdale Fabricators



Ruby+Associates



Ruby+Associates

## PRESIDENTIAL AWARD OF EXCELLENCE FOR ERECTION ENGINEERING

### Hard Rock Stadium Shade Canopy Erection Plan, Miami Gardens, Fla.

**HOW'S THIS FOR** an construction challenge: Erect a 14-acre structural steel shade canopy weighing more than 17,000 tons over an existing NFL stadium.

Thanks to Ruby+Associates, which provided full erection engineering services to fabricator/erector Hillsdale Fabricator, the challenge was successfully completed.

Designed by architect HOK and structural engineer Thornton Tomasetti, the canopy was part of a \$500 million renovation of the 65,000-seat Hard Rock Stadium in Miami, home of the Miami Dolphins, Miami Hurricanes and Orange Bowl. The canopy is supported by a total of eight super-columns. Transfer trusses spanning between pairs of these columns support a 350-ft-tall spire near each corner of the structure, and 64 structural cables, up to 5 in. in diameter and up to 300 ft long, extend from the top of the masts to sus-

pend portions of the canopy. Ruby provided comprehensive erection engineering, including demolition procedures for existing scoreboards; steel erection plans; structural cable tensioning and installation plans; crane placement, clearance and capacity studies; design of temporary falsework; design of specialty erection aids; development of rigging arrangements; and an emergency hurricane bracing plan.

One of the primary objectives of Hillsdale's erection approach was minimizing the impact of the canopy installation on the existing stadium. Typically, a structure of this magnitude requires a great deal of shoring for temporary support during construction. The bid documents suggested an erection procedure using 24 shoring towers. Not only would this shoring have been expensive and time-intensive to install, but it also would have required extensive repairs to the stadium after removal.



Hillsdale Fabricators



Hillsdale Fabricators



Ruby+Associates



Ruby+Associates

## The carefully considered erection plan for the new canopy minimized the impact on the existing structure. —Lynda Leigh

Instead, Ruby developed an innovative steel erection plan requiring minimal shoring and no alterations to the existing stadium. A temporary falsework system was shoehorned into each corner of the stadium. The falsework system allowed for the installation of the lower mast section and cross transfer truss. After these members were installed, the falsework was removed.

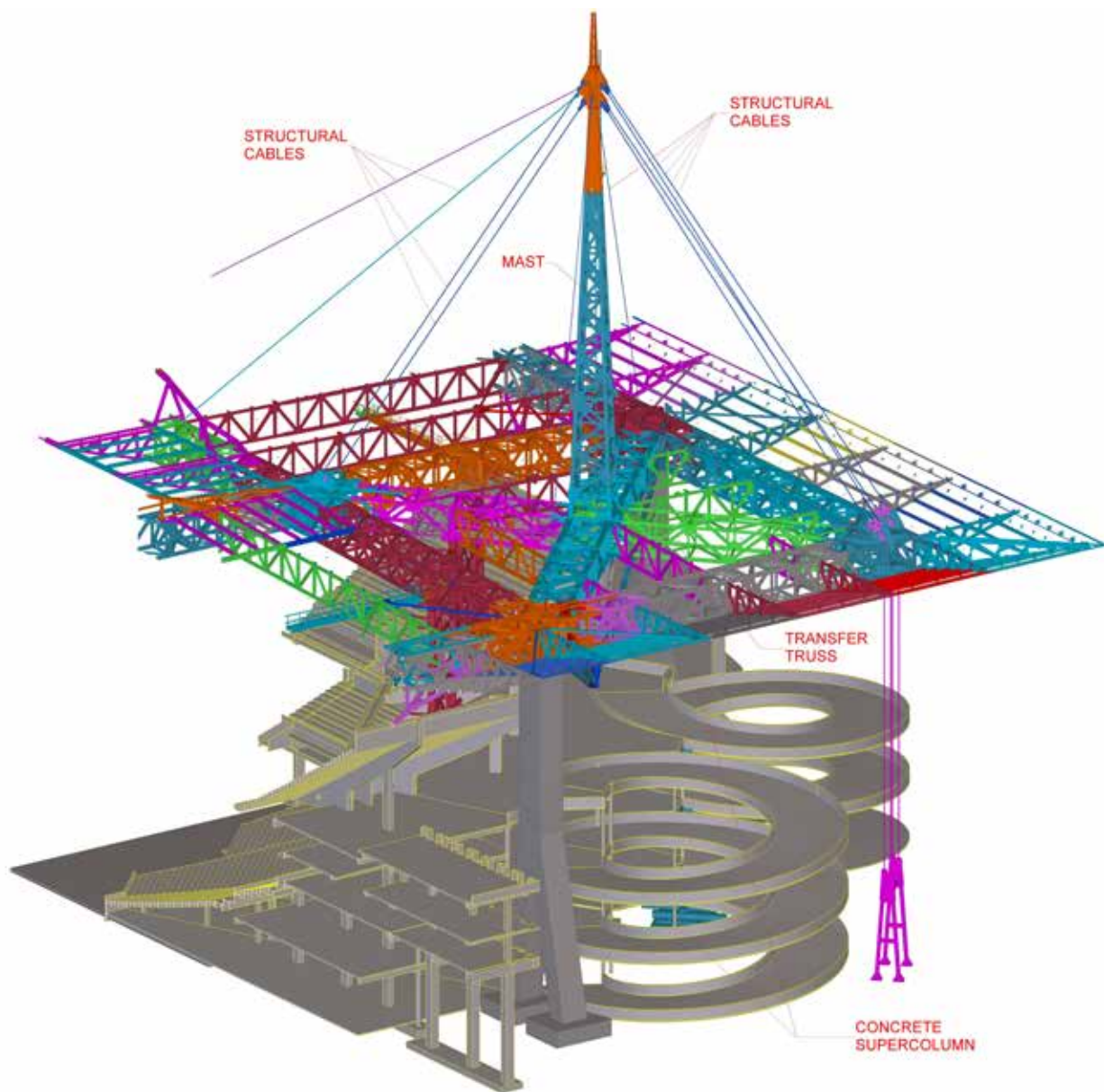
An aspect of the erection scheme borrowed from bridge construction was the use of balanced cantilevers. By sequencing construction such that loads imposed on the canopy structure stayed in balance, each corner of the structure could be erected in its entirety. Temporary tendons provided support until the mast and permanent structural cables were in place. Once the four corners of the canopy were erected, work progressed to the installation of the upper mast and structural cables, the end zone framing and finally the sideline framing. Another method used to limit shoring and speed construc-

tion was the subassembly of components into large, self-supporting sections. Hillsdale was very familiar with this method, having used it successfully on numerous complex power plant projects.

The largest lifts on the project, weighing up to 700 tons, were the outer box trusses. Each of these lifts was accomplished using four large mobile cranes. Ruby designed special lifting frames to ensure that loads were equally shared by the cranes throughout each lift. Ruby designed and produced shop fabrication drawings and developed load testing requirements for the lifting frames, each weighing only 17.5 tons but capable of safely lifting 350 tons.

In addition to the four-crane outer box truss lifts, modular pre-assembly necessitated 25 additional multi-crane lifts, each carefully planned to ensure sufficient crane clearance and capacity—and above all, safety. Ruby's erection scheme also used the permanent structural cables to support portions of the structure during con-





struction. The firm developed drawings addressing cable installation sequencing and tensioning, and designed an apparatus capable of applying more than 600 tons of pretension to each cable.

One of the project's most complex lift sequences involved the installation of a portion of the inner sideline box truss, two roof modules and the 300-ft-long sideline cable, using three mobile cranes. Each of the cranes performed multiple operations during the sequence. The initial length of the sideline cable was precisely calculated to ensure that the cantilevered end of the box truss was left in a super-elevated position, so that installing subsequent canopy steel and other applied roof dead loads would cause the cable and structure to deflect into their intended final positions. Any final adjustments to the cable length would be made using the adjustable cable fittings provided with the cables and the Ruby-designed tensioning apparatus.

To predict the construction stresses and deformations, as well as cable loading/deformation at each stage of erection, a sophisticated analytical model was prepared using SAP 2000. This model predicted the behavior of the extremely indeterminate structure with incredible accuracy, minimizing the number of costly and cumbersome cable readjustments.

This project's complexity, combined with a challenging schedule, required intense preplanning followed by daily problem solv-

ing during construction. Midway through construction, the NFL awarded Super Bowl LIV to the newly christened Hard Rock Stadium. And on September 1, 2016, less than eight months after start of steel erection, the stadium opened on time for the first scheduled Miami Dolphins football game of the season.

#### Owner

The Related Companies, New York

#### General Contractor

AECOM Hunt, Indianapolis

#### Architect

HOK, Kansas City

#### Structural Engineer of Record

Thornton Tomasetti, Washington, D.C.

#### Erection Engineer

Ruby + Associates, Inc., Bingham Farms, Mich.

#### Steel Team

##### Fabricator and Erector

Hillsdale Fabricators, St. Louis



##### Detailer

Esskay Structures, India



A stunning demonstration of the adaptive reuse  
of a historic steel-framed building in a manner  
that made the structure come alive.  
—John Cross



Tom Harris - TH Photography

## PRESIDENTIAL AWARD OF EXCELLENCE FOR ADAPTIVE REUSE

### ProMedica Corporate Headquarters, Toledo, Ohio

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**PROMEDICA'S NEW HEADQUARTERS** comprises the adaptive reuse of not one but two existing buildings: a historic Daniel Burnham-designed steam plant dating back to the late 19th century and a brutalist bank building—both adjacent to Promenade Park on the Maumee River in downtown Toledo, Ohio.

Built in 1896, the former building served as a power plant until 1930, when it was converted to a steam plant to supply steam heat to downtown buildings. The plant closed in 1985 and lay vacant and shelled for nearly 30 years until its recent transformation into a 124,000-sq.-ft office building. A new four-story office space was created inside the shell, using the existing roof and existing north, south and west masonry walls to enclose the space, with a three-story portion of the new building extending beyond the original plant walls towards the Maumee River on the east; the existing east masonry wall was demolished.

Structural steel was used to facilitate the desired plan, with most of the steel being exposed. The floor plan both inside and outside the original plant walls consists of large bays (50 ft × 32 ft) to maximize column-free space and employs wide-flange steel composite beams with up to 2 in. of camber. Floor-to-floor heights were also limited by the existing plant's height, thus the majority of the floors use beam depths of 24 in. or less.

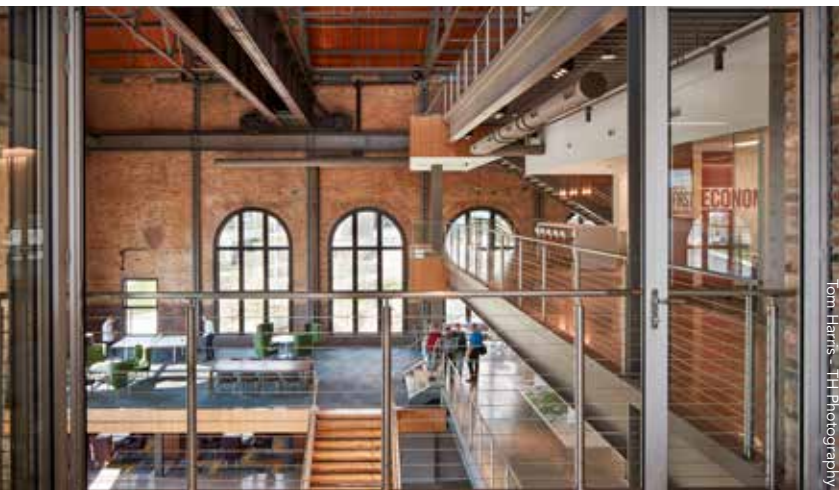
The existing plan incorporates pairs of steel lattice columns, set inside the existing masonry walls, at roughly 16 ft on center, that support steel roof trusses spanning nearly 72 ft between the east and west walls. While the building sat abandoned, exposure to the elements and Toledo seasons left the steel with significant rust, and in some cases with significant degradation. The steel was sandblasted to remove surface rust and accumulated debris, and a minimum steel thickness protocol was established for the



ProMedica



Clint Nash - HKS



Tom Harris - TH Photography



Tom Harris - TH Photography



Tom Harris - TH Photography

lattice column and roof truss evaluation. Members in which the thickness was below the minimum required amount were either replaced or reinforced accordingly. The lattice columns were also cleaned and encased in concrete below grade. These existing columns were used to support the new office floor framing and are exposed throughout the building. All new connections to the 120-year-old steel were bolted, as welding was not a viable option given the original steel's chemical composition.

The existing roof of the plant used clay book tiles and a grid of WT steel members to support them. These tiles and WT members were removed and replaced with 2x6 wood decking running up the slope between steel purlins spanning between the roof trusses. The wood decking is intended to juxtapose the industrial

look of the steel trusses and existing masonry walls, giving the office space a lively and dynamic feel.

Significant time was spent evaluating the two existing masonry pedestals supporting the steel stacks. Unfortunately, despite all efforts, it was determined that the masonry pedestals and steel anchor rods into the masonry pedestal at the base of the stacks were too damaged/degraded to allow for safe remediation. Thus, the stacks were removed and portions of the steel stack rings were reused to create an art installation in the adjacent park called *Echo*. Masonry bricks from the existing pedestals were salvaged and reused to create the new rebuilt pedestals surrounding the new stacks, and the stacks are lit up at night with ProMedica's signature shade of green.



Tom Harris - TH Photography



Tom Harris - TH Photography



Tom Harris - TH Photography



Scott Withers - HKS



Scott Withers - HKS

On the south side of building is a large open atrium that extends from the ground level to the roof. To brace the existing south wall of the building at the atrium, an exposed W30×235 (LSH) spanning between the existing masonry walls was used. The W30 connects to the existing south wall at roughly 12 ft on center with threaded rods and adhesive. The original crane beam was moved and positioned above this open atrium to serve as a reminder to the history of the site, and the crane rails also run the full length of the building, serving as a girder for the fourth-floor framing; these crane rails originally served to support the crane beam wheels as the crane rolled through the plant, moving heavy equipment. The crane rails connect to the existing lattice columns with a bracketed connection near the finished fourth-floor elevation of the office space. ■

**Owner**

ProMedica, Toledo, Ohio

**General Contractor**

Rudolph Libbe Inc., Walbridge, Ohio

**Architect**

HKS, Inc., Chicago

**Structural Engineer**

HKS, Inc., Dallas

**Steel Team**

**Fabricator and Detailer**

Art Iron, Inc., Toledo, Ohio



**Erector**

GEM, Inc., Walbridge, Ohio

