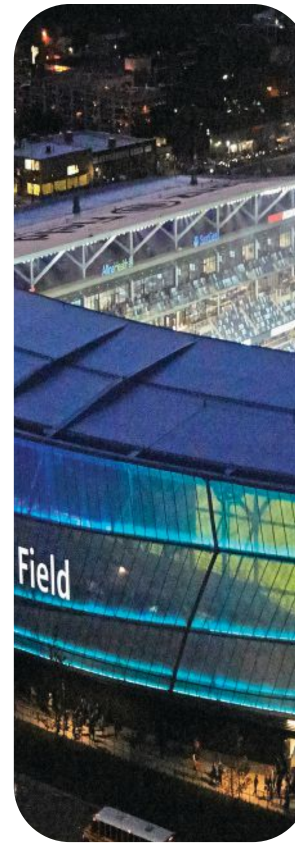


2022 IDEAS^2 AWARDS

A SEATTLE HIGH-RISE using a first-of-its-kind core system. A staircase that looks like a floating ribbon. A performance venue named for a rock-and-roll pioneer. A museum designed to look like an athlete in motion.

What do they all have in common?

They're all steel-framed. And they're all winners.

Specifically, these four projects, as well as five others, are winners of the 2022 AISC IDEAS^2 Awards.

Why "IDEAS^2?" 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, are eligible, and entries must meet the following criteria:

- A significant portion of the framing system must be wide-flange or hollow structural sections (HSS)
- Projects must have been completed between January 1, 2019, and December 31, 2021
- Projects must be located in North America
- Previous AISC IDEAS^2 award-winning projects are not eligible

This year's 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

The entries were placed in four categories according to their constructed value in U.S. dollars:

- Less than $15 million
- $15 million to $75 million
- $75 million to $200 million
- More than $200 million

Two National honors were awarded in the $75 million to $200 million category, and Merit honors were awarded in the More than $200 million, $75 million to $200 million, $15 million to $75 million (two), and Less than $15 million categories. In addition, a Sculptures/Art Installations/Nonbuilding Structures Merit winner was also selected, and one project won a Presidential Award for Excellence in Structural Design.

This year's judging was a bit different than in years past. Instead of having a small panel (typically five or so) judge every category, we expanded the number of judges and split the judging up by category. We also had the submitters of the finalists/highest-scoring projects for each category submit brief videos. From there, National and Merit winners were decided. This year's juries were:

Less than $15 Million

- Scott Blair, Editor-in-Chief, *Engineering News-Record*
- Barbara Simpson, PhD, Assistant Professor, Oregon State University
- Blair Payson, AIA, Principal, Olson Kundig
- John Kennedy, SE, PE, Principal, Structural Affiliates International, Inc.
- Lisa Patel, Certification Technical Services Manager, AISC

$15 Million to $75 Million

- Geoff Weisenberger, Chief Editor, *Modern Steel Construction*, AISC
- Jeffrey Keileh, SE, PE, Project Manager, Plant Construction Company, LP
- David Fennell, Structural Steel Specialist, AISC
- Larry Fahnestock, PE, PhD, Professor and CEE Excellence Faculty Fellow, University of Illinois at Urbana Champaign
- James Puckhaber, AIA, Corporate Practice Leader – Atlanta, The S/L/A/M Collaborative

$75 Million to $200 Million

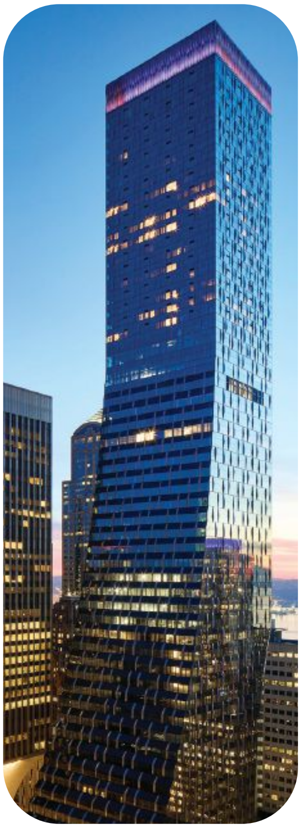
- Monica Shripka, PE, Director of Sales, Marketing, and Business Development, NCSEA
- Raymond Sweeney, PE, Associate, Skidmore, Owings and Merrill
- Negar Elhami, PhD, Associate Professor, University at Buffalo
- Halliday Meisburger, AIA, Associate Partner, ZGF Architects, LLP
- Michael Gannon, SE, PE, Senior Engineer, AISC

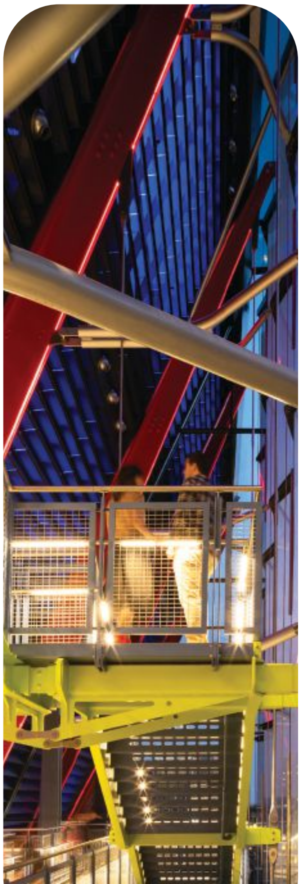
Greater than $200 Million

- Nate Sosin, SE, PE, Vice President, Thornton Tomasetti
- Anthony Massari, PhD, PE, Associate Professor of Practice (Structures), The Ohio State University
- Bruce McEvoy, AIA, Principal, Design Director, Perkins & Will
- Jonathan Tavarez, PE, Senior Engineer, AISC

Sculptures/Art Installations/ Nonbuilding Structures

- Brian Ward, Senior Structural Steel Specialist, AISC
- Scott Melnick, Senior Vice President, AISC
- Rachel Chicchi, SE, PhD, Assistant Professor of Structural Engineering, University of Cincinnati
- Joe Trammell, AIA, JD, Principal, Rule Joy Trammell Rubio
- David Eckmann, SE, PE, FAIA, Senior Principal, Magnusson Klemencic Associates





Max Touhey

MERIT AWARD Greater than $200 Million

One Vanderbilt, New York

ONE VANDERBILT stands out above the rest.

At 1,401 ft, it is Midtown Manhattan's tallest office tower. The $3.3 billion building comprises 1.7 million sq. ft. of office, retail, and amenity spaces while also incorporating $220 million of transit and open-space improvements.

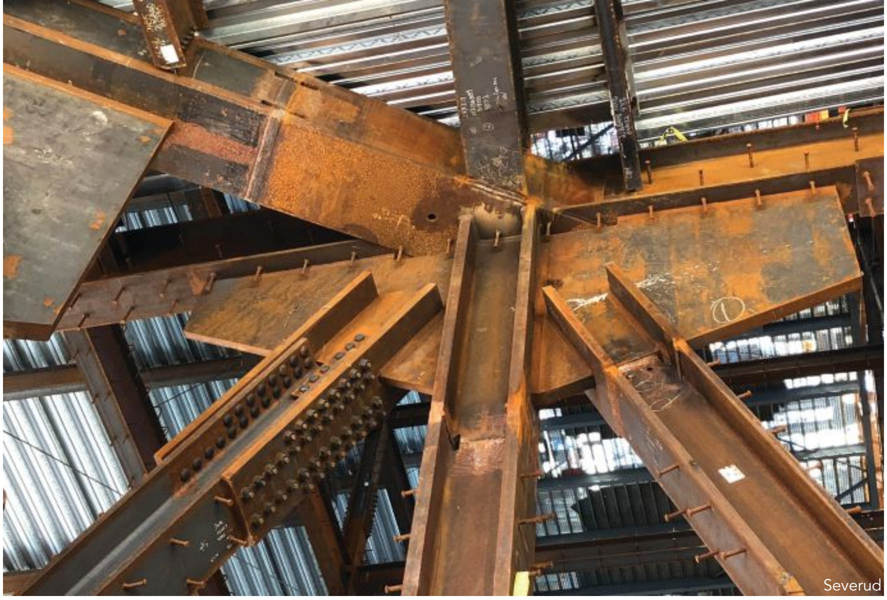
The building's simple geometry of tapering rectangular volumes integrates the aesthetics of the golden age of high-rise buildings with contemporary concepts of designing for sustainability and enrichment of the public realm. The façade is clad in alternating strips of glass and terra cotta and acknowledges the building's proximity to Grand Central Terminal (right across the street) and other historical buildings. A dramatic fourth-floor cantilever creates a setback through which the Vanderbilt corner of the landmarked terminal can be viewed without obstruction.

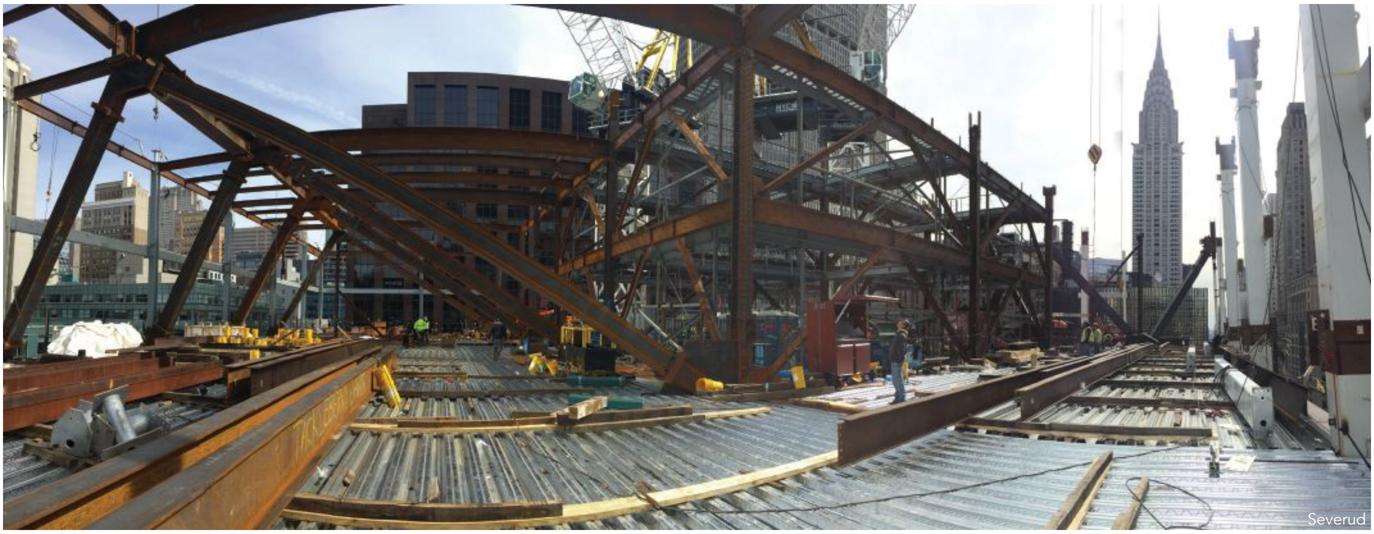
Behind the curtainwall stands a frame designed by structural engineer Severud Associates and composed of 26,000 tons of steel. The building features floor-to-floor heights ranging from 14 ft 6 in. to 24 ft, with mostly column-free floorplates and stunning 360° views through floor-to-ceiling windows. The core is a hybrid system of steel framing and high-strength concrete shear walls, which allowed construction manager AECOM Tishman to better control the schedule (the tower was completed six weeks ahead of schedule, despite the onset of the COVID pandemic during its last six months of construction).

Supported by a concrete mat more than 9 ft thick, the core is augmented by steel outrigger trusses at three intermediate levels that were coordinated closely with the MEP consultant to minimize interference with the building's advanced mechanical systems. Additionally, a steel tuned mass damper keeps accelerations within a comfortable range for building occupants.

Column transfer systems at the fifth and 12th floors give the building its distinctive shape and required floor-deep trusses. By using steel members, the engineers were able to reduce the potential obstruction of chords and interior diagonal members. At truss nodes, forgings were used to make connections as compact as possible while also providing a smooth flow of forces and simplifying fieldwork; forged steel is both isotropic and weldable. In fact, where two or more trusses met at the core, no other type of connection would have been practical.

The efficiency and economy of wide-flange sections made them the first choice for the bulk of the building framing, but box columns and built-up plate girders were used where loads exceeded



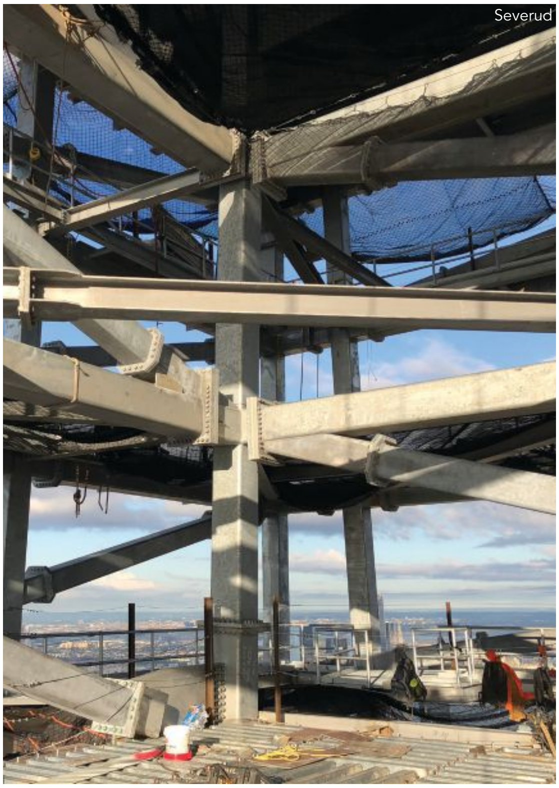


the capacity of rolled members. The availability of plate with different thicknesses and widths coupled with readily adaptable welding details allowed the design team to create sections that could accommodate any geometrical constraint.

At the top of the building, where the “crown” and “snorkel” elements define the upper ends of the building’s tapering rectangular volumes, hollow structural sections (HSS) were the clear choice to support the ins and outs of the curtainwall. Their high capacity in bending—even for large aspect ratios and long unbraced lengths—and their affinity to shop-welded connections simplified fabrication. In addition, field-bolted end-plate splice connections, used for the horizontal and diagonal members, greatly facilitated erection.

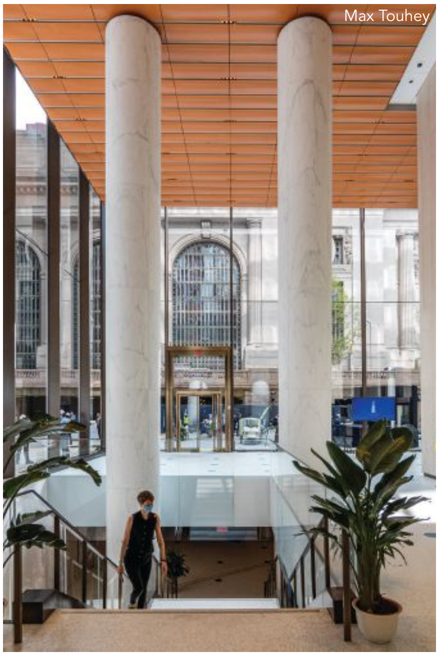
Capping everything off is a 128-ft spire, also constructed of steel plate, atop the snorkel. The spire was fabricated in shippable segments with flanged connections that were easily bolted at the lofty height of 1,401 ft. (Glass was considered for the infill panels, but it could not withstand the heat generated by the nearby exhaust flues.) A separate wind tunnel study determined wind loads and forces and the interaction of the spire with the building frame. As a result, diagonal stiffeners were added to each face of the spire to disrupt wind flow and help control icing. As a bonus, the stiffeners continue the architectural effect of directing the eye skyward to the very top.

The tower employed a steel-first erection sequence pioneered by Severud. Columns, girders, and lateral bracing at the core were designed to stand alone to a maximum height of 12 stories. As steel erection proceeded, reinforced concrete shear walls were placed below. Using a self-climbing form system within the core and hand-set forms from outside, concrete work followed



Severud

Max Touhey



Max Touhey

Max Touhey

the structural steel up the building, usually within six floors from the top. This approach allowed construction manager AECOM Tishman to absorb potential delays in concrete placement while maximizing the impact of speedy erection times on the overall schedule.

The core walls—the primary component of the lateral force-resisting system—are 30 in. thick with compressive strengths up to 14,000 psi; grade 80 steel reinforcement was used throughout. Controlling lateral drift and motion is especially critical to the performance of supertall buildings, so the concrete shear walls are augmented by steel outrigger trusses at three intermediate mechanical levels.

The entire lateral system was designed based on parameters established by RWDI, the project's wind tunnel and micro-climate specialist. In response to their analysis of occupant comfort, a tuned mass damper was added near the building's peak to keep accelerations within comfortable limits. Due to vertical space constraints, a complex system of two steel masses was devised: one hung from above, the other supported on the floor, and each tied to the other to extend the range of vibration frequencies.

After the column transfer systems at the 5th and 12th Floors were erected, optical targets were installed at critical locations on the framing. As erection proceeded, the targets were surveyed from the Chrysler Building and other neighboring towers to confirm behavior and inform the erection process farther up the building, for example, the need for shims at column splices.

*For more information on One Vanderbilt, see "Super Fast, Super Tall" in the March 2021 issue in the Archives section at **www.modernsteel.com**.*

Owner
SL Green Realty Corp.

Construction manager
AECOM Tishman

Architect
KPF

Structural Engineer
Severud Associates Consulting Engineers, PC

Steel Team

Fabricator/Detailer
Banker Steel Co., LLC

Forged Steel Fabricator
Ellwood Specialty Steel

Erector
NYC Constructors LLC

Steve Bergerson

NATIONAL AWARD $75 Million to $200 Million

Allianz Field, St. Paul, Minn.

MULTIPLE ITERATIONS of professional soccer have existed in Minnesota since the 1970s. However, the state never boasted a dedicated Major League Soccer (MLS) stadium.

That changed in April 2019 with the opening of Allianz Field in St. Paul, the new home of Minnesota United FC.

The team's ownership desired a world-class stadium that would also as an iconic piece of art and architecture for the team and state, a venue that would dynamically convey the energy of the play on the pitch to viewers outside and allow them to see into the stadium. It also needed to appear light, airy, and transparent yet still capable of standing up to the harsh Minnesota winters. Architect Populous' design response is defined by a translucent skin wrapping around the entire stadium, made asymmetric and sinuous to avoid the horizontal "wedding cake" look of many traditional stadiums, and supported by large-diameter round hollow structural steel (HSS) shapes.

Meeting this vision required an innovative digital design process that used a common central geometry file for structural analysis, architectural design, and ultimately material fabrication. The common platform enabled near-real-time design iterations between all parties working as one project team, not individual firms. Using a common platform allowed for rapid 3D visualization enabling more informed and timely decisions to be made that were in the best interest of the project as a whole.

Walter P Moore integrated the structural frame analysis and fabric membrane analysis, which allowed for the optimization of the entire structural steel system. The integrated design captured the undulating geometry, varied loading conditions, and complex interface between materials resulting in an extremely cost-effective design without compromising the ambitious design vision. And a structural steel package totaling 4,500 tons was the easy, economical choice for the primary and secondary structure due to a variety of factors: lack of repetition, long cantilevers, irregular geometry, and schedule.

Complementing the façade, a large canopy protects fans from unpleasant weather while leaving the pitch open to the elements allowing fans a true open-air stadium experience. A variety of canopy shapes and types were considered early in the design process, including a tensile fabric canopy, cantilevered truss, and a cantilevered propped girder system. Ultimately, the propped girder system was chosen as the most economical system for the size of canopy desired. The resulting 145,000-sq.-ft canopy covers approximately 85% of the seats, simultaneously protecting fans from the elements and reflecting sound onto the pitch below.

Structural steel framing creates a light and graceful support of the large canopy while having sufficient strength to support the large snow loads typical of a Minnesota winter. A 3-in. steel deck spanning 13 ft was used to minimize the number of purlins supporting the canopy. Each purlin frames into a large wide flange girder at each gridline, at a 42-ft, 8-in. bay width. The girder cantilevered out 78 ft from the back-of-bowl column and is supported by a single strut that props the girder up. Although this results in a slightly heavier system than a cantilevered truss due to additional bending imposed on the girder, it creates a much more open structure and has fewer pieces to fabricate and erect. At the leading (inner) edge, the girder tapers down from 36 in. to 16 in., matching the depth of the steel purlins creating a consistent thin profile around the stadium. At the north end of Allianz Field, the canopy gracefully swoops down, lowering the overall profile of the stadium.

For the signature feature—the building skin—Walter P Moore partnered with Saint-Gobain to develop a new polytetrafluoroethylene (PTFE) fabric that provided both strength and transparency. In order to minimize cost, the fabric needed to span as far as possible between support lines, which induces large bending loads in two directions along those support lines. Simultaneously, those support lines needed to curve around the stadium, creating the desired architectural appearance. Round 18-in.-diameter HSS provided the ideal support system. These sections, dubbed "driver pipes," serve to "drive" the skin's complex geometry and create the supporting structure that gives the skin its distinctive form.

The PTFE fabric was connected to a continuous aluminum extrusion that was then connected back to the driver pipes through a built-up, tee-shaped plate assembly at 18 in. on center. To provide additional tolerances, the plate had four slotted holes at a 45° angle in each corner, which allowed the aluminum extrusion to move vertically or horizontally to maintain proper alignment. The driver pipe connection back to the column assembly was through an endplate to resolve the bi-axial moments and large axial loads. The connection used slip-critical bolts in oversized holes allowing the diver pipe to be adjusted during erection into its precise final location.

In addition, Populous desired the exterior skin to appear continuous without any noticeable joints. Achieving this vision required eliminating expansion joints from the driver pipes. The result is that the driver pipes act as a giant rubber band encircling the stadium. They expand and contract with changes in temperature, resulting in substantial loads within the driver pipes. The structural team took advantage of the natural breaks in the stadium seating bowl corners to allow the seating bowl and west premium tower to breathe naturally. This approach transfers most of the large thermal stresses from the driver pipes into a select few corner columns resulting in a far more efficient structural system.

To achieve the owner and architect's ambitious vision, Walter P Moore's structural and enclosure teams knew traditional design and coordination techniques would not be sufficient. The critical innovation was the common digital data platform shared by the structural and architectural design teams and, ultimately, the steel fabricator. During the design process that began in 2015, Walter P Moore and Populous developed a digital workflow to incorporate complex architectural geometry into structural models rapidly and communicate back the impacts in quick turnarounds to modify the architectural design. This created a symbiotic relationship between


Justin Barton

M A Mortenson Company


M A Mortenson Company

MNUFC

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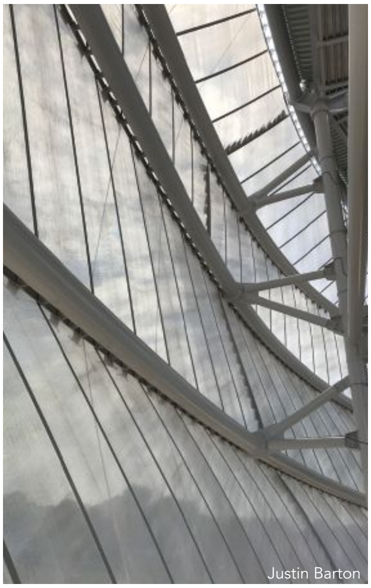


Justin Barton

Justin Barton

design, analysis, and performance. Essentially, this equated to having a single file in which all parties were accessing, processing, manipulating, and rapidly sharing the data, which enabled quick decision making and led to an efficient system within the time and budget constraints. The numerous iterations of the overall geometry optimized design aesthetics and cost efficiency simultaneously.

Another innovation took advantage of steel fabricator Merrill Steel's trucking equipment and proximity to the job site (180 miles). The canopy girders/struts were fully fabricated in the shop, painted, shipped to the site, and then erected as a single piece to sit directly on the building columns. The longest canopy-plus-back-span piece shipped to the site measured 110 ft long (78 ft cantilever plus 32 ft back span), 19 ft deep, and 23 tons. Due to the preassembled shop fabrication of the canopy, two canopy girder/strut assemblies were erected per day. The entire 145,000-sq.-ft canopy was erected in just 18 weeks, including the erecting in the harsh months of January and February. Assembling the full girder/strut allowed for aesthetically pleasing welded connections to be used. Additionally, it allowed a higher quality paint system, without field painting or field bolting of surfaces, that will increase the longevity of the paint and steel system.

*For more information on Allianz Field, see "Soccer Star" in the July 2019 issue in the Archives section at **www.modernsteel.com**.*

Owners
Minnesota United FC
The TEGRA Group

General Contractor
M.A. Mortenson Company

Architect
POPULOUS

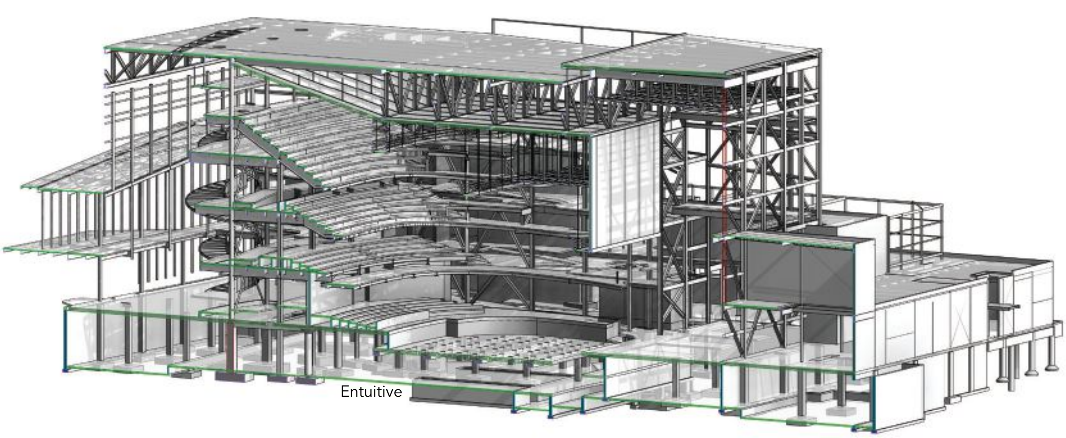
Structural Engineer
Walter P Moore

Steel Team

Fabricator/Detailer
Merrill Steel AISC CERTIFIED FABRICATOR

Erector
Danny's Construction Company AISC ASSOCIATE AISC CERTIFIED ERECTOR

Bender/Roller
Max Weiss Company AISC ASSOCIATE



NATIONAL AWARD $75 Million to $200 Million

Buddy Holly Hall of Performing Arts and Sciences, Lubbock, Texas

THE SPIRIT OF BUDDY HOLLY is alive and well in the form of a steel-framed performing arts center in the famed rocker's hometown.

Completed last year, the Buddy Holly Hall of Performing Arts and Sciences in Lubbock, Texas, has fulfilled the aim of creating a hub for the arts and culture community as well as a venue capable of attracting world-class performances. In addition, the new $158 million venue plays home to Ballet Lubbock, the Lubbock Symphony Orchestra, and the Lubbock Independent School District Visual and Performing Arts. At a total of 218,000 sq. ft, it houses the 2,297-seat Helen DeVitt Jones Theater, the 415-seat Crickets Theater (named for Buddy Holly's band), a 5,600-sq.-ft multipurpose room, a 20,000-sq.-ft ballet school, a 3,300-sq.-ft restaurant, 21,400 sq. ft of back-of-house space, 36,100 sq. ft of lobby space, and a 6,000-sq.-ft covered outdoor event/performance space.

The complex was initially conceived as a predominately reinforced concrete building, with structural steel framing limited to the roof over the theaters and main lobby, the monumental stair, and a few other select elements. But on the advice of the construction manager, the team developed an alternative scheme that expanded the use of structural steel to include all the above-grade framing, including the theater balconies, the main theater stage, and the lobby was developed. In this scheme, reinforced concrete was limited to the foundations and the ground floor, as well as the two elevator cores, the exterior portion of the roof/canopy that formed the bird's tail, and the tilt-up walls on the studio theater.

The team completed an evaluation of both schemes using the criteria of cost, schedule, the size of the relevant skilled labor pool, the availability of tradespeople in the local marketplace, and the

Casey Dunn

Casey Dunn

ability for the quality expectations established with the Owner to be met. The structural steel scheme was determined to have an advantage in every category and was given the green light as the project proceeded into the design development phase.

The main performance space, the Helen DeVitt Jones Theater, presented multiple structural challenges and opportunities. The audience chamber, with a large main level and three horseshoe-shaped balconies, was designed to enhance audience proximity to the performers on stage, creating a "not a bad seat in the house" scenario. Theater balconies of this type are typically constructed out of reinforced concrete, so using structural steel framing instead required some creative thinking. The geometry of each balcony was highly complex, requiring careful thought on the framing layouts, member selection, and connection details to achieve practical, cost-effective, and buildable solutions.

A series of balcony rakers cantilever up to 32 ft from columns placed just behind the theater back wall. Vibration from rhythmic activities on the balconies was a major consideration given the large cantilever length of the rakers. The design uses 40-in.-deep rakers cranked in several locations to follow the profile of the balcony. The design team used the curved horseshoe shape as an advantage, with a tension ring member placed near the front of the balcony to meet the vibration limits. To maintain a thin edge profile and sightline clearances below, a shallower 14-in.-deep section was spliced onto the end to create the front two rows of the balcony. The horseshoe nature of the balconies required each of the structural steel members for the risers to be bent to follow the curvature of the space.

On the lower balconies, standard wide-flange beam sections are used for the risers, which span between the rakers, support concrete on deck for the treads, and serve as formwork for the concrete risers. However, on the uppermost balcony, the height of the risers meant that the use of standard steel sections was not practical or cost-efficient. To address this situation, the team created a steel "Z" profile that was not only curved but also varied in height to follow the profile of the seating. This profile was created by bending an angle for the top and an angle for the bottom flanges, followed by welding on a variable height steel plate for the web. Web openings were then incorporated to allow for air distribution below each of the seats.


Entuitive


Casey Dunn

Above the audience chamber, a series of structural steel trusses frame the roof. Deck on purlins is supported by the sloping truss top chord to follow the roof profile. The elevation of the bottom chord of the trusses was tailored to achieve the optimum audience chamber volume from an acoustics perspective. Concrete on metal deck with sufficient mass for acoustics was then provided to create the ceiling, with the deck dropped down between the audience chamber ceiling beams and the bottom chord of the trusses. Openings are provided in this ceiling cap to allow for retractable acoustic banners to allow for further tuning of the audience chamber.

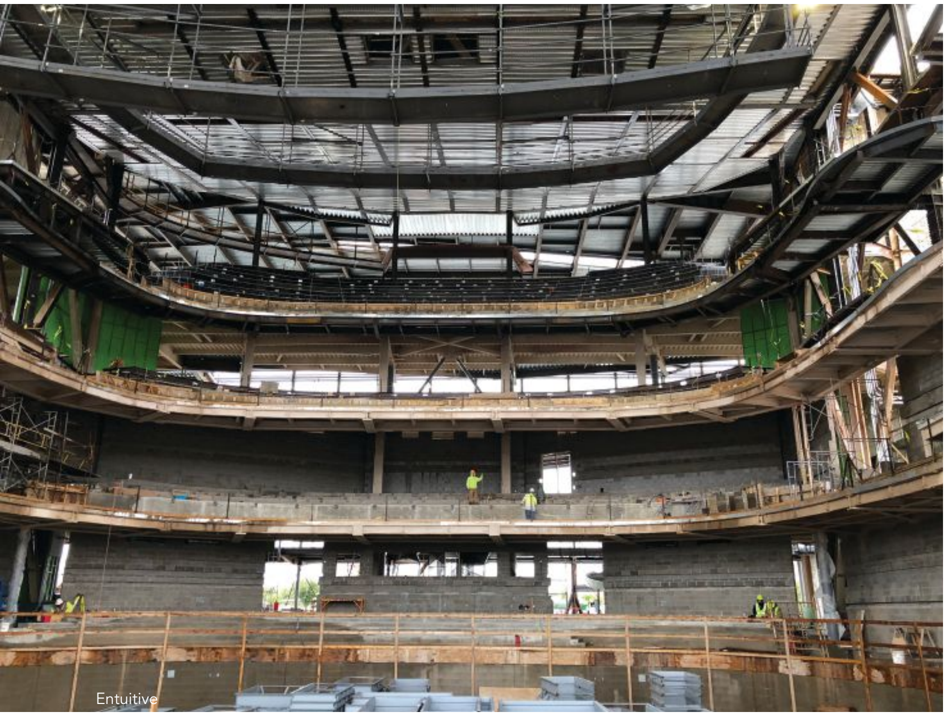
Steel also helped achieve structural success in the three-story Christine DeVitt Main Lobby. A dramatic shift inward of the main exterior wall at the upper levels of the lobby was driven by aesthetic and acoustics considerations. To keep the lobby space column-free, a roof truss spanning more than 150 ft was introduced along this line. The 45-ton truss varies in depth from 12 ft at supports to 14 ft at midspan, which was achieved through a sloping top chord, and was erected using two cranes. This truss supports many different elements, including the lobby roof, exterior cladding, the lower sloping roof overhang, and the main entrance canopy. The exterior of the building was inspired by the colors and shapes of the landscape of West Texas, including the prismatic and layered rock formations of nearby canyons, and features a combination of solid panels and linear windows suspended from this truss.

The bottom of this cladding is terminated by a sloping roof that pushes out from the exterior line above and is supported by a line of columns along the curtain wall below. The roof then continues by cantilevering past the columns to provide a sunshade to the curtain wall from the Texas sun. The back span of the sloping roof is supported from the truss. Round, slender, architecturally exposed structural steel (AESS) hangers emerge from below the sloping roof and extend down to support one end of custom tapered plate girders at level 2. These custom tapered plate girders support the VIP lounge area on level 2 and then cantilever out 25 ft to create the main entrance canopy, which is a modern take on the marquee.

The visual highlight of the lobby, the monumental stair, conveys a grand architectural and structural statement thanks to hollow structural sections (HSS) and steel plates. The stair soars 56 ft across three stories and uses 145 tons of steel. The aesthetics of a thin outer edge and glass guard is contrasted with the solid white plastered central spine, with the latter supporting cantilevering stair treads that vary in length between 8 ft and 14 ft. To form the helical shape of the stair, the HSS chords for the central spine and outer stringer were bent in two directions through induction bending. The HSS riser, steel plate tread, and outer HSS stringer were then connected to the central spine before finally welding the central spine web plate onto the HSS chords. The long spans, slender profile, low mass, and low damping ratio resulted in a low-frequency system that was particularly vulnerable to vibrations from human activity. Through finite element modeling and analysis, the team found that supplementary damping was required to meet the vibration limits, so a tuned mass damper (TMD) was added on the second and third flights of the stair.

Another significant element in the lobby, a series of glass fiber-reinforced concrete fins, also benefited from HSS. The fins not only add a dynamic aesthetic element but also contribute to shading the large expanse of curtain wall. The challenge was how to support these undulating fins, which are situated 5 ft off the curtain wall while giving them the appearance of floating. The solution was to fit a slender structural steel element within the profile of the fin, one that brought enough strength to support the fin weight and sufficient stiffness to prevent wind-induced fluttering. The team considered several HSS sizes and profiles, such as circular and rectangular, that were strong and stiff enough but could not fit within the sleek architectural profile of the fins—but oval HSS could. These elements were hung from the sloping roof overhang above, and the


Lee Lewis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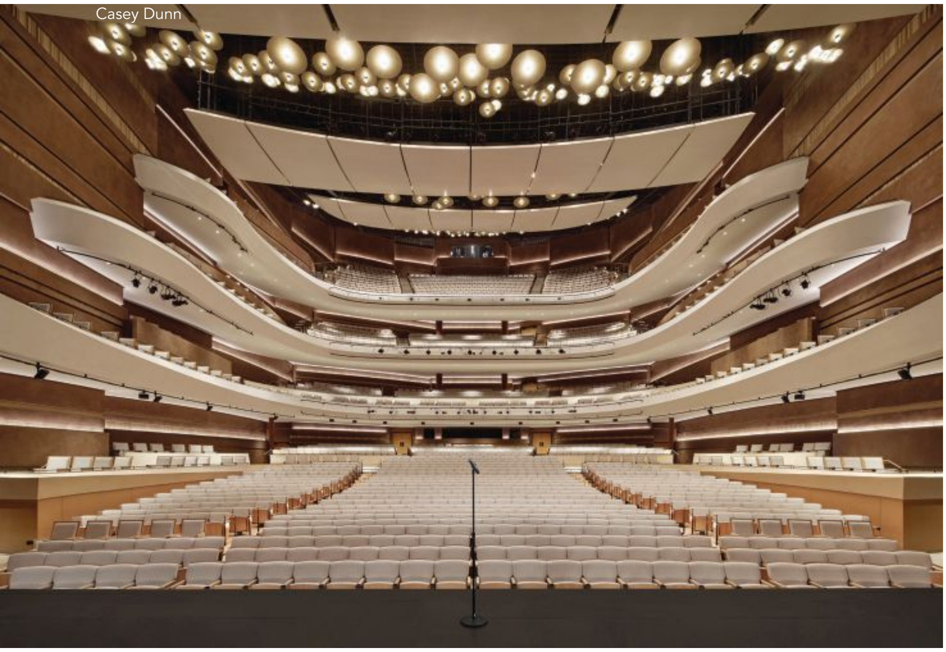

Casey Dunn

profile for each one was varied over its height by splicing three sections together; oval HSS11×6 was used inside the fin, and oval HSS8×4 was used above and below the fin.

Given the complexity of the project—which involved three architectural firms and three structural engineering firms, all responsible for different areas of the complex—the larger structural engineering team made the conscious decision to share and work in one Autodesk Revit model for the project and produce one consolidated set of construction documents. Using Autodesk BIM 360 and a live chat feature made this level of collaboration and coordination between different offices possible—e.g., two of the engineering firms coordinated in real time on the superstructure and substructure as each responded to the design progression and coordination from the broader team.

One other example of the project team's collaboration in action is in the theater, where the related engineer used a parametric Grasshopper model developed by the design architect to generate the custom balcony risers inside Revit as 3D parametric objects, as this was the only efficient way to convey the extremely complex geometry. The architects then used the live model for their background, with the engineer controlling future adjustments in the Revit model to precisely coordinate the steel framing with the refinements to the architectural profiles—much like a musical ensemble performing in the space would work in perfect harmony.

Owner
Lubbock Entertainment and Performing Arts Association

Developer/Other Consultant
Garfield Public/Private LLC

General Contractor
Lee Lewis Construction, Inc.

Architect
Diamond Schmitt

Architect/Structural Engineers
MWM Architects
Parkhill

Structural Engineer
Entuitive

Steel Team

Fabricators
Basden Steel Corporation, Inc. AISC CERTIFIED FABRICATOR
TrueNorth Steel AISC CERTIFIED FABRICATOR

Erector
Deem Structural Services, LLC AISC CERTIFIED ERECTOR

Detailer
Foy Consulting & Engineering, LLC AISC DETAILER

Bender/Roller
Albina Co., Inc. AISC ASSOCIATE

Nic Lehoux

MERIT AWARD $75 Million to $200 Million

International Spy Museum, Washington

THE INTERNATIONAL SPY MUSEUM needed a new place to hide in plain sight.

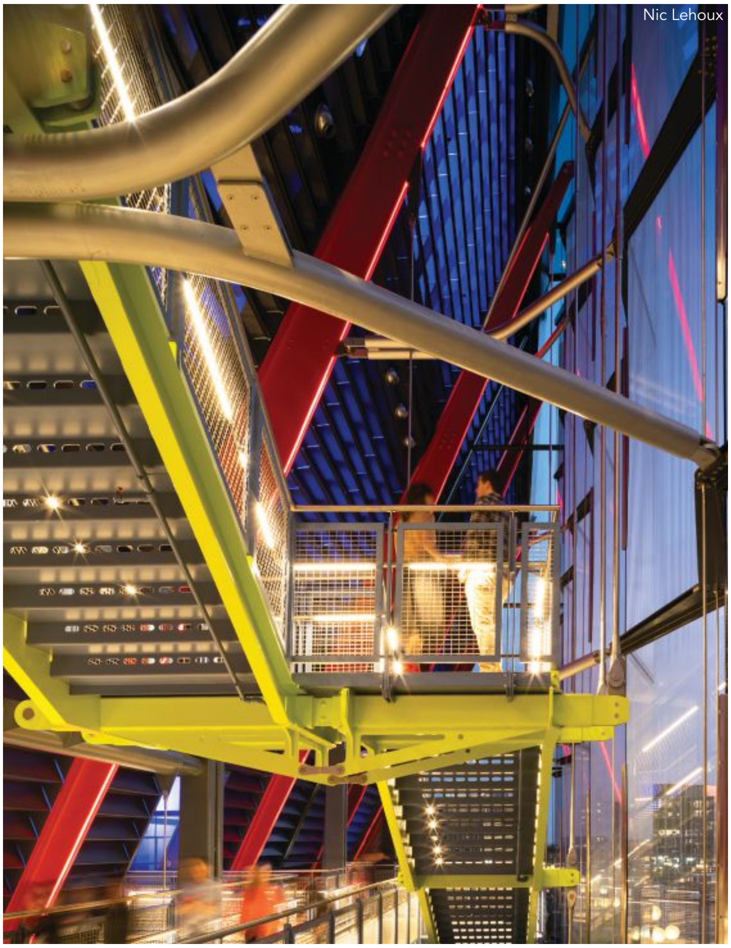
Having outgrown its original home in Washington, D.C.'s Penn Quarter, the organization was in pursuit of a new iconic location that would allow it to effectively continue its mission of educating the public and showcasing the history of espionage. The Museum identified 700 L'Enfant Plaza, a few blocks south of the National Mall, as the ideal location to meet its needs. The new steel-framed, 141,000-sq.-ft, eight-story, $162 million project includes three floors of museum exhibits resting on a base of retail, education, and lobby spaces. The facility is topped with offices, additional educational space, and a dramatic events facility with a green rooftop and sweeping views of the city.

The overarching goal was to create a world-class museum with Smithsonian-level thermal and humidity controls in an architecturally impactful building. The Museum partnered with JBG Smith, then hired Rogers Stirk Harbour + Partners and Hickok Cole to make their vision a reality. Creativity and collaboration were critical to the success of this project, which was to be built above an existing operational subterranean shopping mall and garage that support a major Washington Metro station and surrounding office buildings. The team was also faced with a strict budget and a 48-month design and construction schedule.

Washington is generally known as a "concrete town," where cast-in-place concrete structures are prevalent. However, as design discussions began during the early phases of the museum project, it became clear that structural steel was the best choice for the building structure, as steel provided the greatest flexibility needed to achieve the desired design aesthetic as well as provided engineering, constructability, and cost benefits.

The building's concept is a play on the business of espionage: being hidden in plain sight. One of its main architectural features is a five-story glass atrium, dubbed the Veil, that is suspended in front of an enclosed exhibit box and feature staircase. This unique structure provides a stage for the movement of people throughout the exhibit levels, contributing to the pedestrian experience along 10th Street. With its evocative form, powerful exposed structural steel sloped columns, and pleated glass veil, the Museum serves as a catalyst to revitalize L'Enfant Plaza.

Within the Veil lives an intricate series of monumental stairs and platforms constructed from architecturally exposed structural steel (AESS) members of varying shapes and profiles, all of which had expressed connections to the built-up AESS building columns. Structural steel provided the strength and stiffness needed to achieve the architectural vision for this space by keeping the structural members as small and attractive as possible. Another dramatic example of the museum's elegant design is the series of "L-shaped" red-painted columns, constructed from grade 50 steel plates, along the south and west faces that slope at an angle of approximately 2.5:1 vertical to horizontal and serve as part of the building's


Nic Lehoux


Nic Lehoux

gravity load-carrying system. The columns taper and have reduced depths at the top where structural demand diminishes to reduce material cost and for aesthetics.

The museum superstructure is constructed above an existing four-story concrete structure built in the 1960s, and the addition of a new building above was not anticipated in that original design. In order to support the new museum superstructure loads, strengthening of the existing concrete structure was necessary. It therefore became very important to keep the museum's structural weight as minimal as possible in order to make this existing strengthening cost-effective—another reason to employ a structural steel frame. The typical museum floor system consisting of long-span steel beams and girders with lightweight concrete on composite metal deck provided the open spaces required for the museum programming while minimizing the self-weight of the structure. In addition to factoring in the existing building space below the museum, the project also had to factor in the proximity of the surrounding buildings and streets. As the site is not much larger than the building footprint, the project required closely coordinated deliveries and tight sequencing.

Steel brought several advantages from a constructability perspective as well. The construction schedule for the project was aggressive from the start, and steel allowed the building superstructure to be completed in a faster timeframe than would have been possible with cast-in-place concrete options. In addition, by implementing a design incorporating structural steel with unshored composite metal deck construction, the need for expensive and intricate concrete formwork was eliminated from the project.

The entire team understood from the outset of the project that challenges would arise due to the complex design. Months of preplanning, 3D modeling, mockups, and field tests were performed to ensure that what was shown in the model could actually be built in the real world. One complication became evident during non-destructive testing of splices between the building structure and the sloping column cantilevers. The cantilever sections were W30×124 sections with ¾-in. web doubler plates on each side of the web. These cantilevers were then spliced to main building beams made with the same built-up section with a complete-joint-penetration (CJP) splice. When ultrasonic (UT) testing was performed, the interface between the doublers and the webs of the W30 beams created false-negative results, but the engineer and testing agency responded by developing a testing procedure that would satisfy the design requirements.

From a design standpoint, the museum makes its mark by featuring AESS as a prominent portion of the architecture and structure and wasn't just employed as a highlight or an accent. Unlike most projects in our hard work and structural craftsmanship is often hidden or covered by fireproofing/finish trades, the structural steel is the premier architectural feature seen by museum patrons, visiting tourists, or even those passing by on nearby I-395. As such, a high level of coordination was required at the sloping front of the building, where the curtain wall and monumental stair are both connected back to the sloping steel columns. Due to the design of the sloping columns, connection points for the curtain wall and stair had to be incorporated into the shop fabrication of these columns. This meant that connection points had to be coordinated with each supplier's internal tolerances and also allow for the project-specific steel erection tolerances. Both the stair hangers and curtain wall connections were attached back to the columns by a 2-in. pin, so there was no room for error once the structural steel was fabricated and erected.

Another façade system that had to be factored in was the metal panel rain screen system. To support this system, vertical W6 girts were placed around the entire building perimeter 5 ft on center. Due to the project schedule, these metal panels could not wait for field dimensions to be taken between sloping columns prior to production, so the location of the steel columns had to fall within the prescribed AESS tolerances. The majority of this coordination took place by way of model sharing between individual subcontractors and a weekly, sometimes daily, building information modeling (BIM) process in which the team established allowable tolerances and individual system requirements.

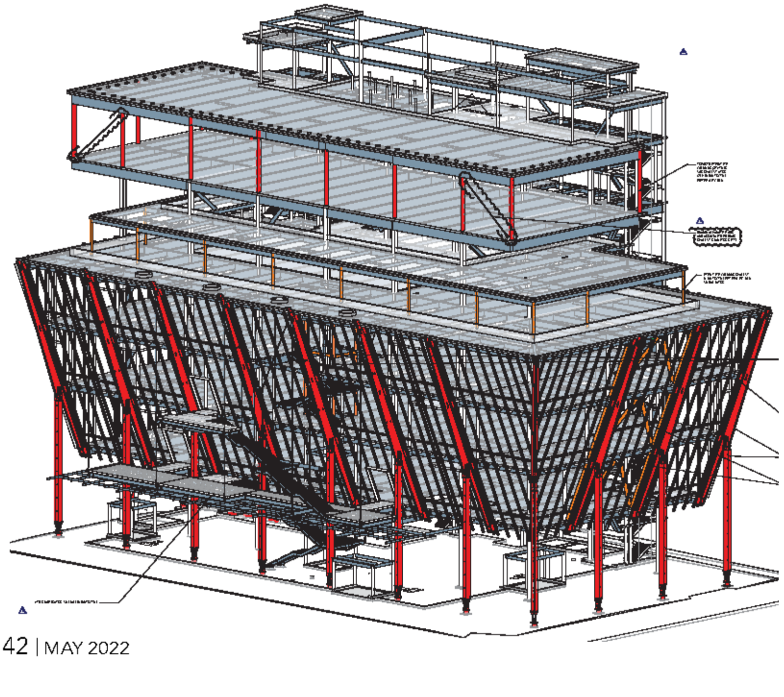
The various AESS elements also involved different finish requirements, some of which necessitated different fabrication and erection details in order to accommodate the different coating types and thicknesses. These included AESS that would remain uncoated for fireproofing, interior AESS prime painted for finish coats, interior AESS prepped for intumescent coatings, exterior AESS hot-dip galvanized and prepped for finish coats, and exterior AESS hot-dip galvanized prepped for intumescent coatings. To make sure the finish of each piece of steel was correct, the steel team traded color-coded models with the design team to visually check and ensure each piece came to the field with the correct finish. (For more on the various AESS levels and their individual requirements, see "Maximum Exposure" in the November 2017 issue in the Archives section at **www.modernsteel.com**.)

Of course, like the activities of a spy, time was of the essence with this project. Steel fabricator SteelFab's involvement began approximately one year before it was awarded the contract for the structural steel package. During this time, conceptual and schematic design-level feedback was provided to general contractor Clark Construction and the rest of the design team about some of the feature elements on the building. The willingness of the project team to engage a steel fabricator well ahead of the procurement stage helped steer certain design decisions in directions that maintained the architectural intent but allowed for more fabrication- and erection-friendly details.

Had this project been procured under a typical design-bid arrangement, it wouldn't be an exaggeration to say that three to four months would have been added to the structural steel schedule alone. A significant portion of the upfront work on the project involved delving into the details of earlier discussions about coatings, connections, tolerances, and AESS expectations in general. Only with the full buy-in of all project team members was this kind of progress achieved in such a short amount of time.

For more information on the International Spy Museum, see "I Spy" in the June 2021 issue in the Archives section at ***www.modernsteel.com****.*

Dan Cocciardi



Owner's Representative
JBG SMITH

General Contractor
Clark Construction Group, LLC

Design Architect
Rogers Stirk Harbour + Partners

Architect of Record
Hickok Cole

Structural Engineer
SK&A Structural Engineers, PLLC

Steel Team

Fabricator
SteelFab, Inc. AISC CERTIFIED FABRICATOR

Erector
Memco LLC

Detailer
Prodraft, Inc.

Ashley Murphy

MERIT AWARD $15 Million to $75 Million

United States Olympic and Paralympic Museum, Colorado Springs, Colo.

THE NEW UNITED STATES Olympic and Paralympic Museum in Colorado Springs is intended to be a celebration of the Olympic and Paralympic Games as well as the participants themselves—so much so that the building is wrapped in an aluminum facade that mimics the appearance of an athlete's costume.

This façade is stretched over a steel superstructure composed of 9,000 diamond-shaped panels that produce gradients of color and shade, giving the building another sense of motion and dynamism.

The museum also acts as an anchor for the new City for Champions District, forming a new axis and bridging downtown Colorado Springs to America the Beautiful Park. The design of the 60,000-sq.-ft building was founded on the idea of a continuous path from the top to the bottom to allow for accessibility, a key element of the project, to create a museum in which all visitors could enjoy the same experience.

The steel-framed building is composed of four volumes, arranged in a pinwheel formation that contains galleries, an auditorium, and events space surrounding a central atrium. Because steel is a material that can be easily manipulated, cut, and rewelded into many different shapes and forms, it could most easily accommodate the versatile shapes needed for the spiraling nature of the floors and overall complex geometry. It was also capable of supporting the long trusses, cantilevers, and sloping columns and floors most efficiently and also provided the fastest speed of construction.

Scofidio + Renfro

KL&A

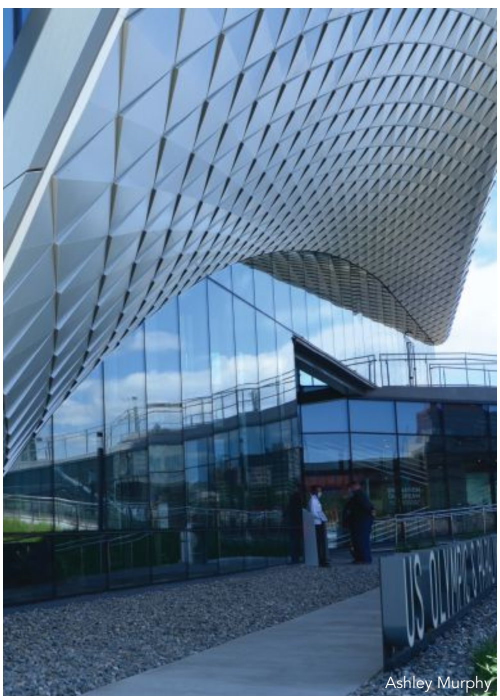
Ashley Murphy

The structural system offers an open, inviting façade to the public while evoking movement. It involved a variety of load path solutions that needed to be achieved to ensure the dynamic nature of the building, including a 140-ft-long-truss, tilted columns, and cantilevered floor members. Due to the building's unorthodox shape, the steel framing and the aluminum façade both lean away from the center, which made steel erection more challenging than what would be associated with a more typical grid. The construction team countered this situation by placing temporary shoring points and implementing an extensive erection sequence before other tiebacks within the building could be made. In addition, the leaning nature of the building's exterior required the lateral system to resist not only traditional wind and seismic loading but also loading from the gravity system.

Speaking of the façade system, each of the 9,000 metal panels has its unique conditions, including the connection of the exterior walls to the floor and roof elements. A special clip was fabricated by the metal stud provider that allowed for the skin's exterior framing to be adjustable for each individual condition. The panels are all folded in half, with a visible crease that creates two triangles, a design decision that led to a large amount of model testing and digital studies to discover the panels' reaction to light. The possibility emerged for these "scales" to animate the surface as the light changes in Colorado Springs throughout the day.

Early involvement of the steel detailer, fabricator, and erector was extremely beneficial to the project, with all parties being at the table for most of the design meetings starting as early as schematic design and through to the construction documents phase. This approach helped the team coordinate how the loads needed to be placed to efficiently create the building. In fact, structural engineer KL&A also performed the steel detailing, which further enhanced the collaborative process. The relationship helped resolve an issue during construction where one of the concrete cores was misaligned near the top by roughly 5 in. The integrated approach between structural engineer/steel detailer and steel fabricator helped resolve the issue by quickly revising several connections, a scenario that mimics the individual contributions to teamwork that the museum celebrates.

KL&A



Ashley Murphy

Owner
United States Olympic & Paralympic Museum

General Contractor
GE Johnson

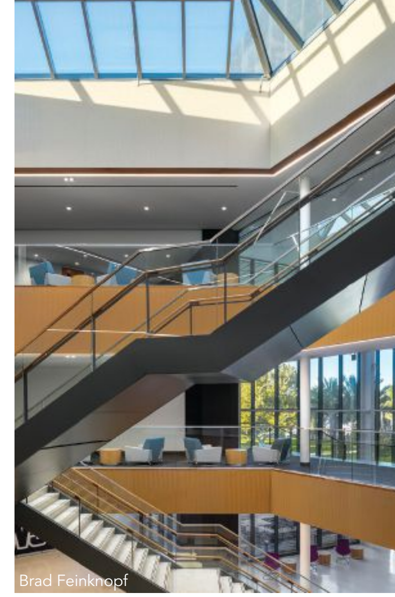
Architects
Anderson Mason Dale Architects
Diller Scofidio + Renfro

Structural Engineer
KL&A Engineers and Builders

Steel Team

Fabricator
Drake-Williams Steel AISC CERTIFIED FABRICATOR

Erector
LPR Construction AISC ASSOCIATE



MERIT AWARD $15 Million to $75 Million

L. Gale Lemerand Student Center, Daytona Beach, Fla.

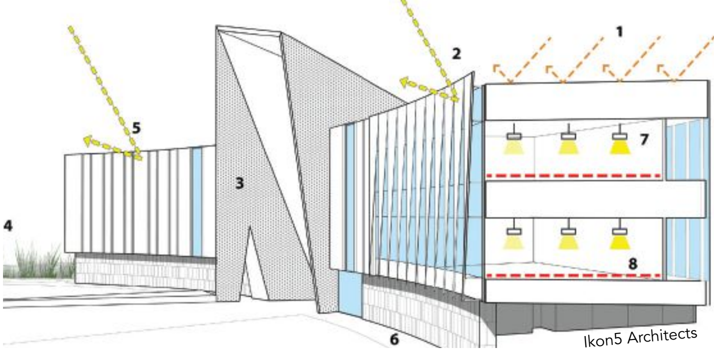
COLLEGES AND UNIVERSITIES often design buildings as "gateways" from a town to a campus or from one campus area to another. In the case of Daytona State College's new steel-framed student center, this approach was more than just figurative.

The Board of Trustees envisioned the new building as a gateway that would transform the college's appearance to the community of Daytona Beach and better represent its mission of advancing the economic development of the city and Volusia County.

The existing campus essentially "turned its back" on the community of Daytona with inward-looking and internally accessed buildings surrounded by parking lots between public roads and the campus. The effect was that of a shopping mall. The new 75,000-sq.-ft steel-framed student center on the edge of campus reverses this perception with a massive bronze-clad gateway portal between the community and the campus, emphasizing transparency and openness.

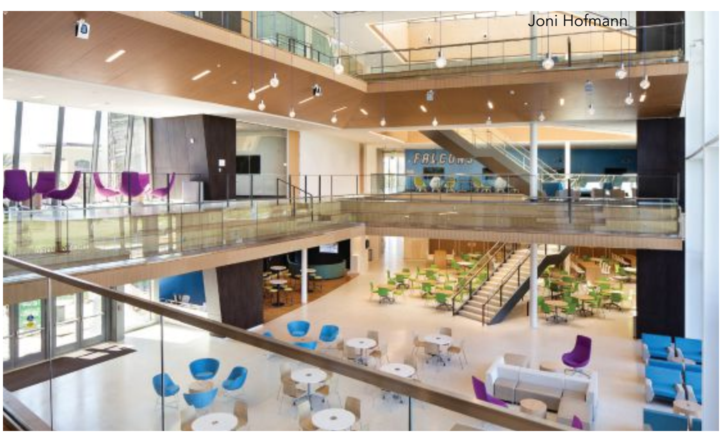
Like coral stone outcropping rising from the Floridian shoreline, an organically curving coral stone and bronze wall faces the world-famous Daytona International Speedway Boulevard and embraces visitors like two outreached arms forming a landscaped welcome lawn at the campus entry. Rising from the center of the gently curving wall is the portal, framing the opening to the student center and giving passage to the main quadrangle and campus beyond. Additionally, to allow open access to the center of campus, a portion of the curving stone wall cantilevers above grade to allow students and staff to pass unimpeded from parking to the campus quad.

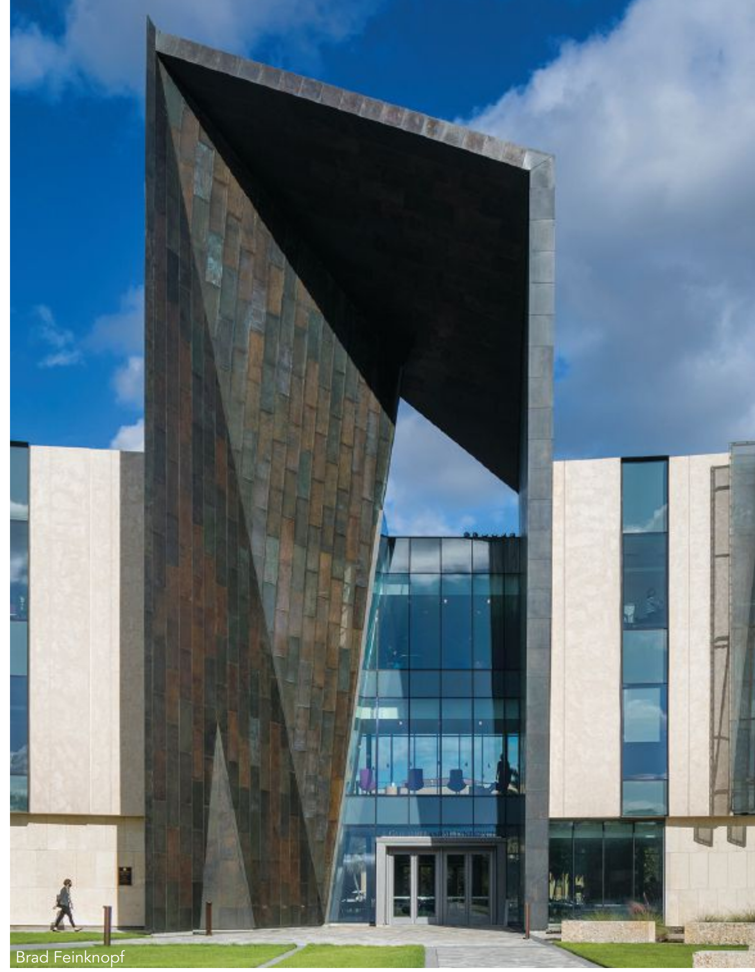
The design team selected structural steel because it possessed the best performance characteristics to achieve the project goal of openness. Most prominently, it allowed the team to economically and efficiently create the 90-ft-tall portal in the center of the building that both separates and joins each wing (side) while also effectively resisting hurricane-force winds. The light structural steel framing for the



Ikon5 Architects


Ikon5 Architects


Joni Hofmann


Brad Feinknopf


Brad Feinknopf

portal also provided the perfect substrate to anchor the bronze rain screen and easily achieve the screen's angular form. Beyond the gateway, steel frames the rest of the building as well and also facilitates a large opening in the center of the floor plate that creates a three-story student commons with cantilevered amphitheater seating—while *also* transferring lateral loads through the building.

The most significant structural challenge for the project was cantilevering two stories of the student center over the pedestrian pathway connecting the campus parking lot with the center campus quadrangle. The new building's footprint impeded this preexisting pedestrian connection and in order to maintain it, the team lifted the building above grade and cantilevered a portion of the second and third floors over the pathway. The challenging part was creating a rigid frame that would not want to overturn while transferring lateral forces. The solution was to create a Vierendeel truss at the southeast corner of the building, before the cantilevered portion of the floor, and attach the side of the truss to a freestanding stair tower. The structural frame of the stair tower acts as a mast supporting the truss, which in turn supports the second and third floors and allows pedestrians to move freely beneath.

The building's steel framing also assists with the sustainable design strategies of a high-performance building. The large, glazed facades on the south and west express welcome and openness but also presented a significant design challenge for combatting solar heat gain in the steamy Florida environment. The team addressed this situation by designing bronze solar screens to naturally ventilate the façade and reduce heat gain on the building and load on the cooling systems, with the screens being attached to the steel framing.

Owner
Daytona State College

General Contractor
Perry-McCall Construction, Inc.

Architect
ikon.5 architects

Structural Engineer
BBM Structural Engineers, Inc.

Steel Team

Fabricator and Detailer
GMF Industries, Inc.

Erector
GMF Steel Group

MERIT AWARD Less than 15 Million

2Life Communities Administrative Offices, Brighton, Mass.

BRINGING PEOPLE TOGETHER is 2Life Communities' business.

And the affordable senior living community developer's CEO wanted to do the same for its employees and initiated an effort to relocate the administrative staff of 55, which was previously spread across its Brighton campus, all under one roof in a collaborative, inclusive, and equitable office culture.

The company decided to build two floors on top of one of its existing facilities, which acts as a link building between two residential towers. The existing building includes a fitness center, a library, an auditorium, and other rooms that support resident programming. And the addition would need to be constructed with no disruptions to the resident floors below.

Because of the way the existing building was designed, it was not possible to support an additional two stories by introducing new columns through the building. The building would need to be supported from the outside, and the solution came in the form of two 90-ft-long steel trusses held up by four exterior steel columns.

In addition, the new structure needed to be integrated architecturally with the existing building. The budget did not allow for the wholesale redesign of the existing building or complicated screens, so the design team needed to get creative. The final design of the addition incorporates the vertical rhythm of the existing building through a perforated corrugated metal screen on the south face of the building that integrates both elements into a cohesive whole, as well as limits direct sunlight and improves overall comfort to occupants in the summer months.

With limited options for placing the large pile-supported footings, the team decided to cantilever the front of the building, which houses conference and meeting rooms that span the building's width. And rather than hiding the trusses, the team decided to celebrate and integrate them into the overall design of the space. As such, the trusses were left exposed and painted a bold yellow.

Owner's Representative
2Life Communities

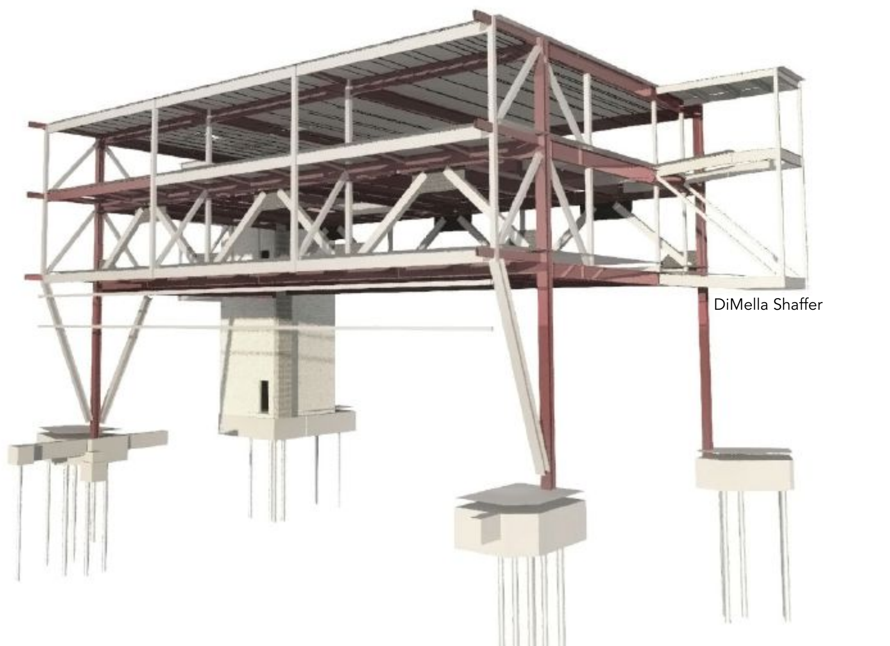
General Contractor
Dellbrook | JKS

Architect
DiMella Shaffer Associates

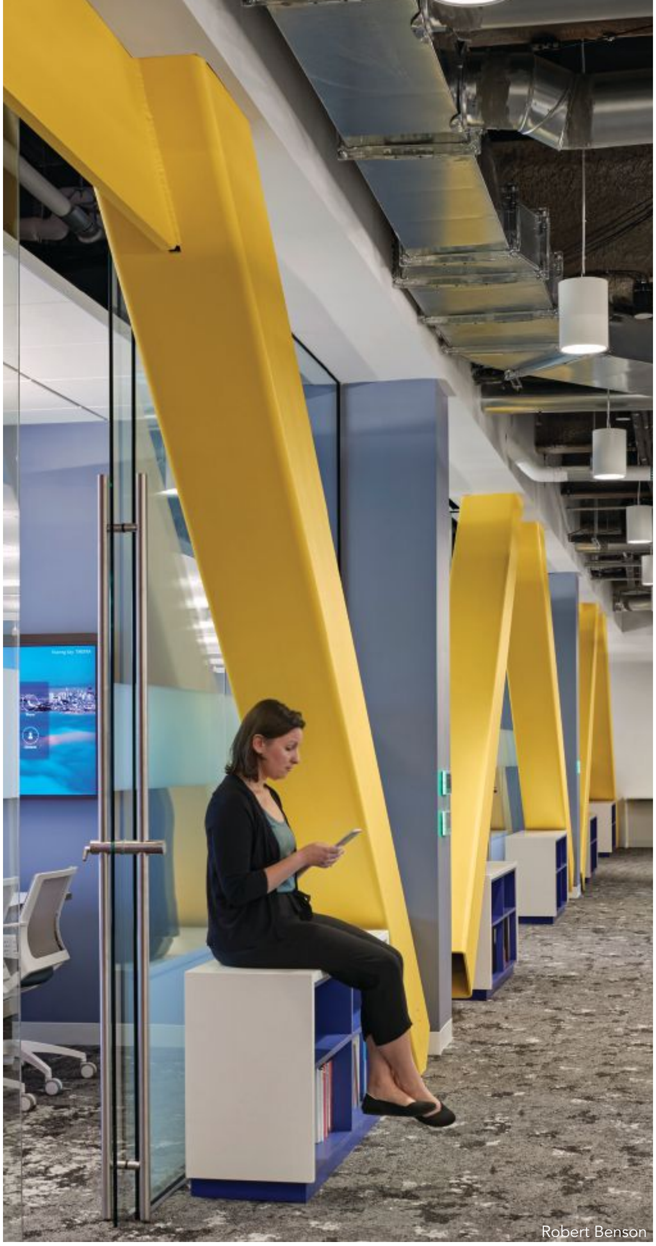
Structural Engineer
Odeh Engineers

Fabricator/Detailer/Erector
Soucy Industries, Inc. AISC CERTIFIED FABRICATOR


Odeh


DiMella Shaffer

Odeh

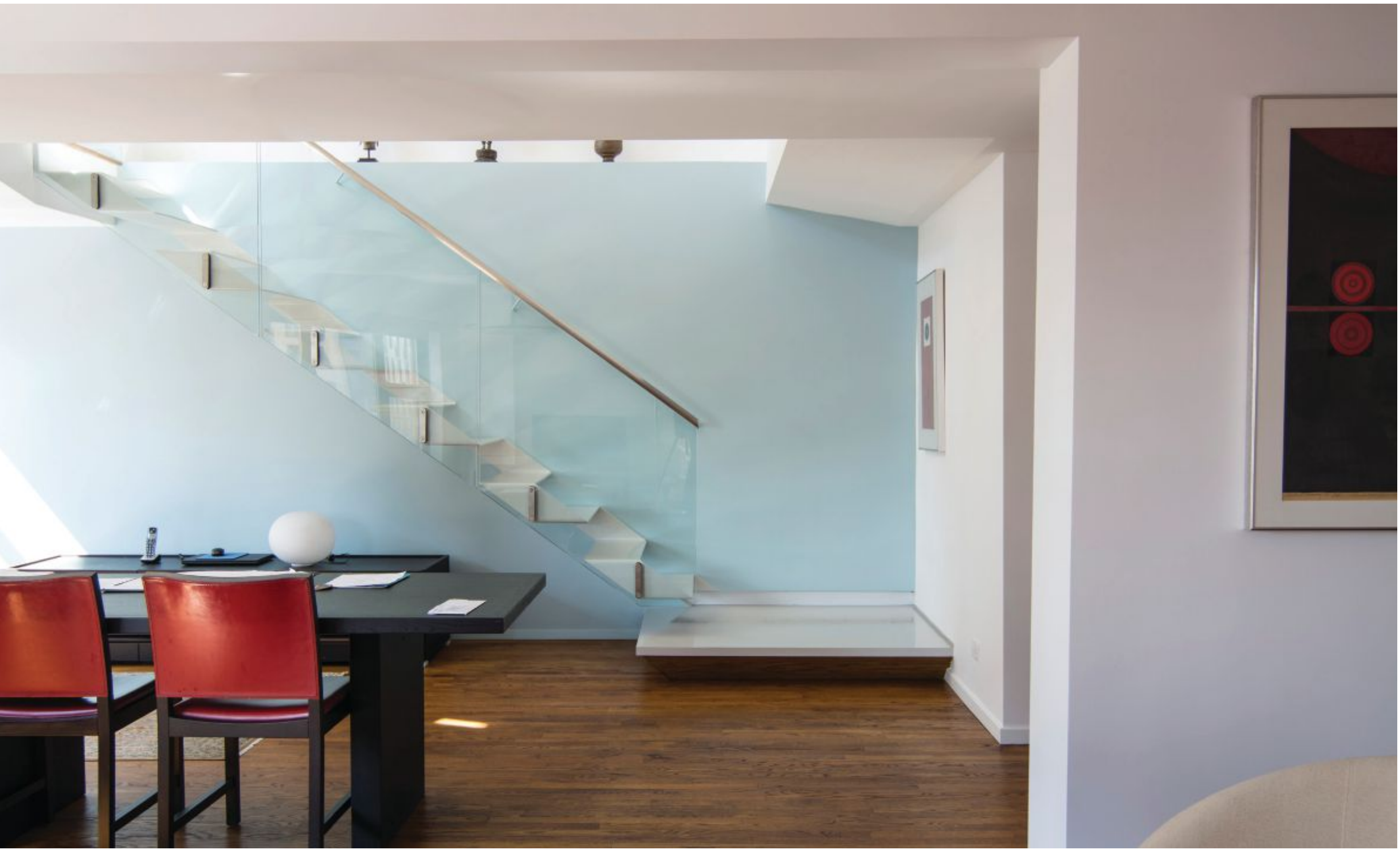


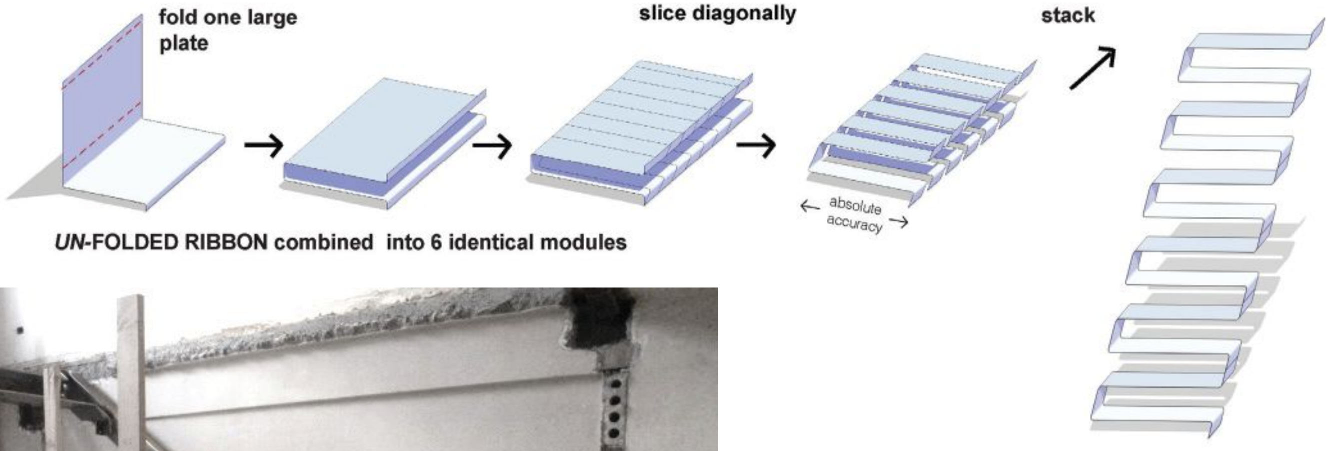
Robert Benson

Robert Benson

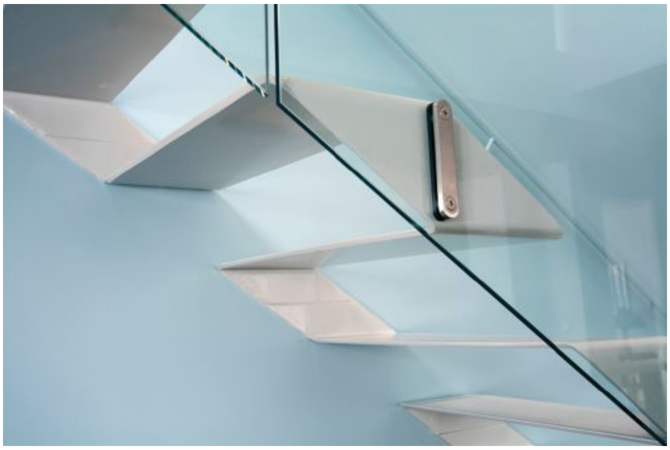
Robert Benson

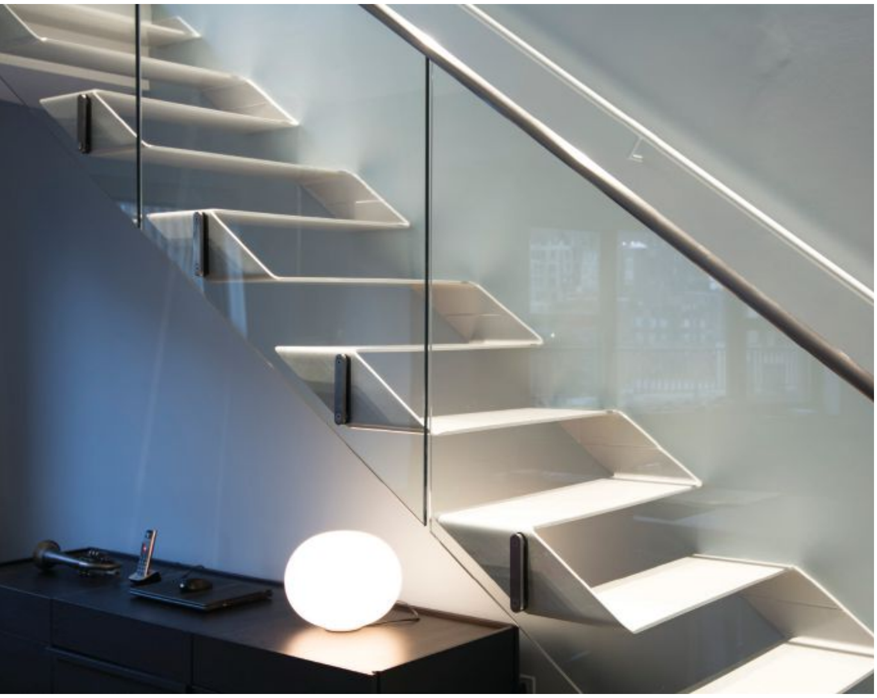
Robert Benson

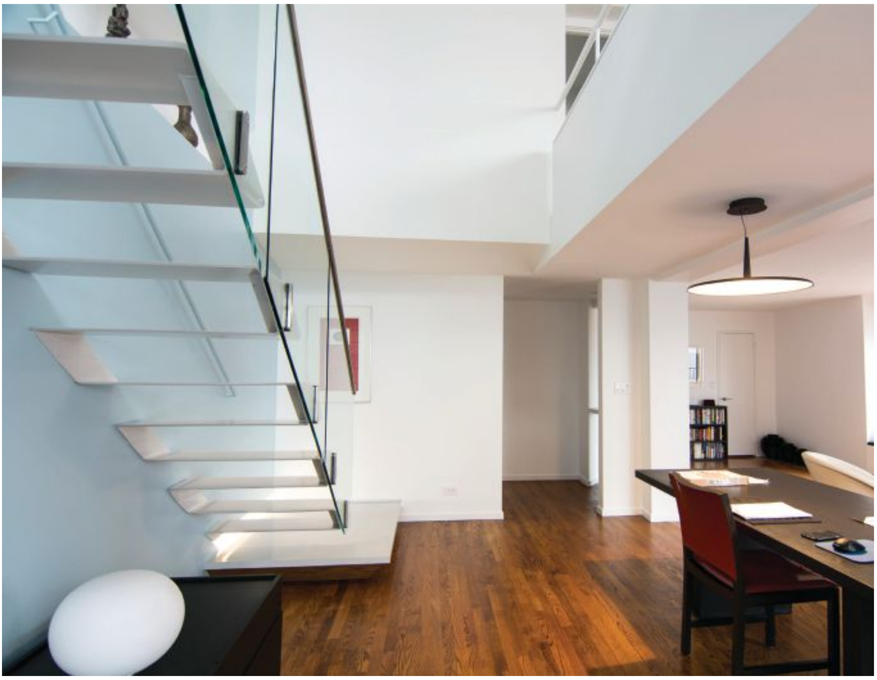




fold one large plate
slice diagonally
stack
absolute accuracy
UN-FOLDED RIBBON combined into 6 identical modules







MERIT AWARD Sculptures/Art Installations/ Non-building Structures

Ascension of the Celestial Maiden, New York

A NEW STEEL STAIRCASE in a Manhattan apartment facilitates movement between floors and adds an artistic centerpiece to a refreshingly renovated space.

The project combines two apartments in a 1960s-era building vertically by opening the floor in the upper unit and inserting a new staircase. The two-story high volume and the staircase were designed to become the focal point of the enlarged apartment while capitalizing on the spectacular views of the East River and the United Nations Headquarters.

Structural steel was used for its slim profile and visual lightness, as well as its ability to create a fluid shape. The staircase was conceptually inspired by paper folding art principles where a single strip forms the flight of risers, and it provides a stark visual contrast to the adjacent demising wall. The continuous ribbon of steel is much more delicate than the typical cantilevered staircase and creates an ephemeral feeling, like the fabric streamers of gymnasts, a ribbon floating in the air, and the transparency through the steps maintains the views and opens up the space. There was very little documentation of the existing structural conditions, and using cranes and large structural elements would have been cost-prohibitive.

To form the staircase, a large standard sheet of ⅜-in.-thick steel was folded just four times, sliced "diagonally" into six identical modules, then finally stacked. This procedure resulted in precisely identical modules that couldn't have been achieved by bending the strips one by one. This accuracy was essential to accommodate the glass handrail, which required precise alignment. Every step has a 1-in. radius to emphasize the continuity of the bent steel plate—nothing to distinguish tread or riser.

While the precision of the project would appear to have been facilitated by high-tech equipment and processes like laser cutting, CNC machines, or waterjets, it was achieved using traditional bending methods and saws, which were deemed more affordable for such a small project. Regardless of the process, structural steel was the only way to achieve this design and its fluid format and visual openness.

Owner
Robert Ciricillo

General Contractor
Excel Builders & Renovators Inc.

Architect
Yoshihara McKee Architects

Structural Engineer
Yoshinori Nito Engineering and Design PC


Moris Moreno

PRESIDENTIAL AWARD FOR EXCELLENCE
In Structural Design
Rainier Square, Seattle

RAINIER SQUARE adds a new and exciting mixed-use destination in downtown Seattle that revitalizes an entire block and its surrounding area—and it's also the first building to implement the SpeedCore system, which has effectively reinvented the rules of high-rise steel construction.

Soaring 850 ft above the city, the 58-story, 1.4 million-sq.-ft tower is comprised of an active retail podium, Class-A office space, and high-rise luxury apartments. It also includes a seven-story, below-grade parking garage that accommodates nearly 1,000 vehicles, and its podium base directly connects to adjacent Rainier Tower.

The building serves as a proof-of-concept for SpeedCore, a novel and innovative structural steel system using modular, prefabricated, concrete-filled, composite-plate steel shear wall (CF-CPSW) panels to create a high-rise tower's structural core quickly and cost-effectively. Originally designed to be built with a traditional, reinforced concrete core surrounded by structural steel, composite floor framing, the project benefitted from the forward-thinking mindset of developer Wright Runstad and Compan, who recognized the opportunity to save time and money by erecting the tower's structural core using SpeedCore.

Constructing Rainier Square required 55 ironworkers and 15,000 tons of steel—including more than 350,000 steel rods with more than 700,000 welds. During construction, the steel faceplates and tie rods of the hollow modules supported eight floors of decking before they were filled with concrete. After the concrete infill was poured and cured, the system worked compositely to create a hardy structural core, with each component doing its part:

- Steel plates provide reinforcement and primary resistance to tension and shear demands on the lateral system.
- Concrete infill provides resistance to larger overturning compressive loads under lateral demands.
- Steel tie rods provide confining pressure for the concrete, resulting in superior seismic performance.

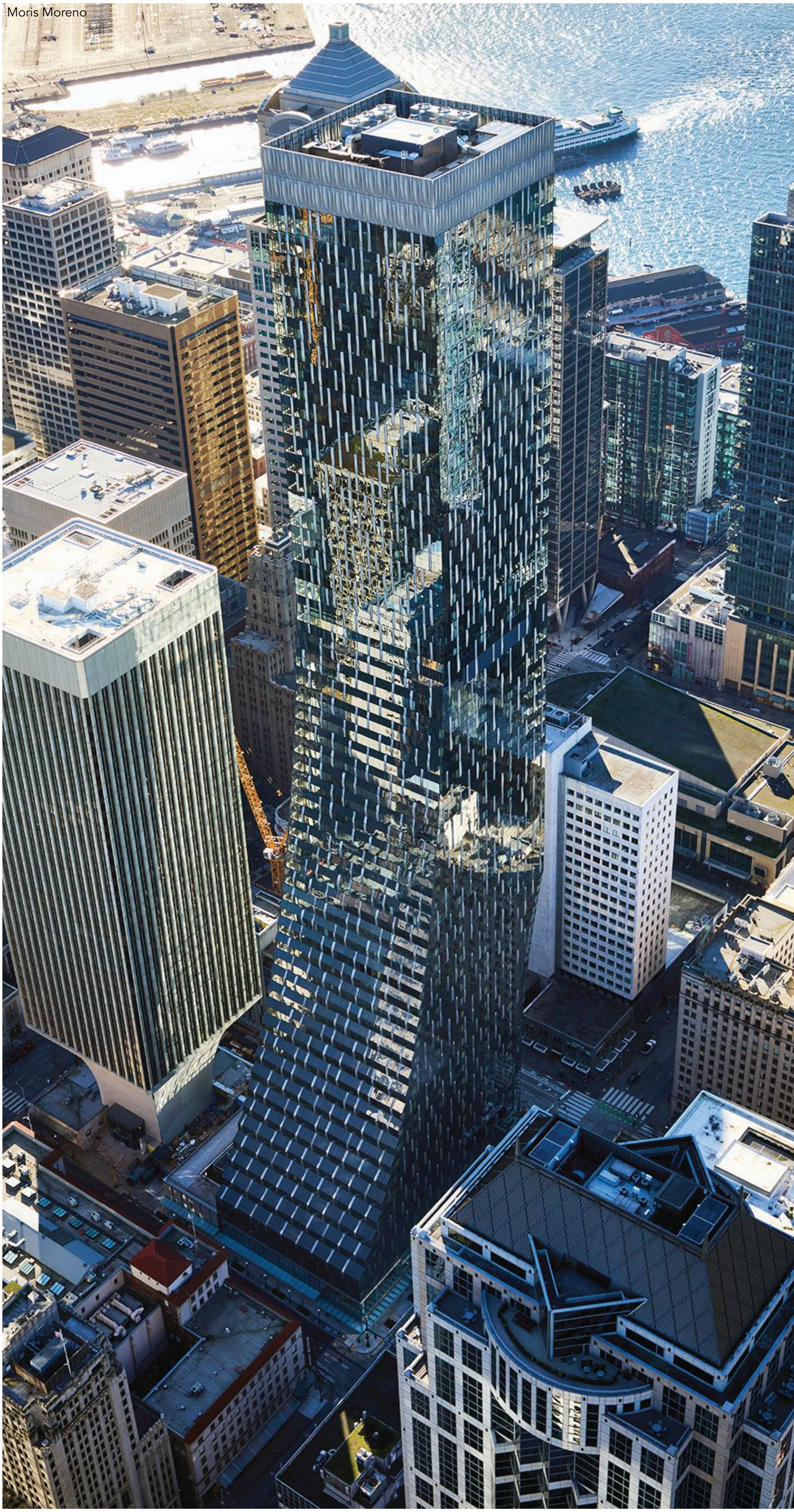
At Rainier Square, SpeedCore's swift construction sequencing involved three high-level steps:

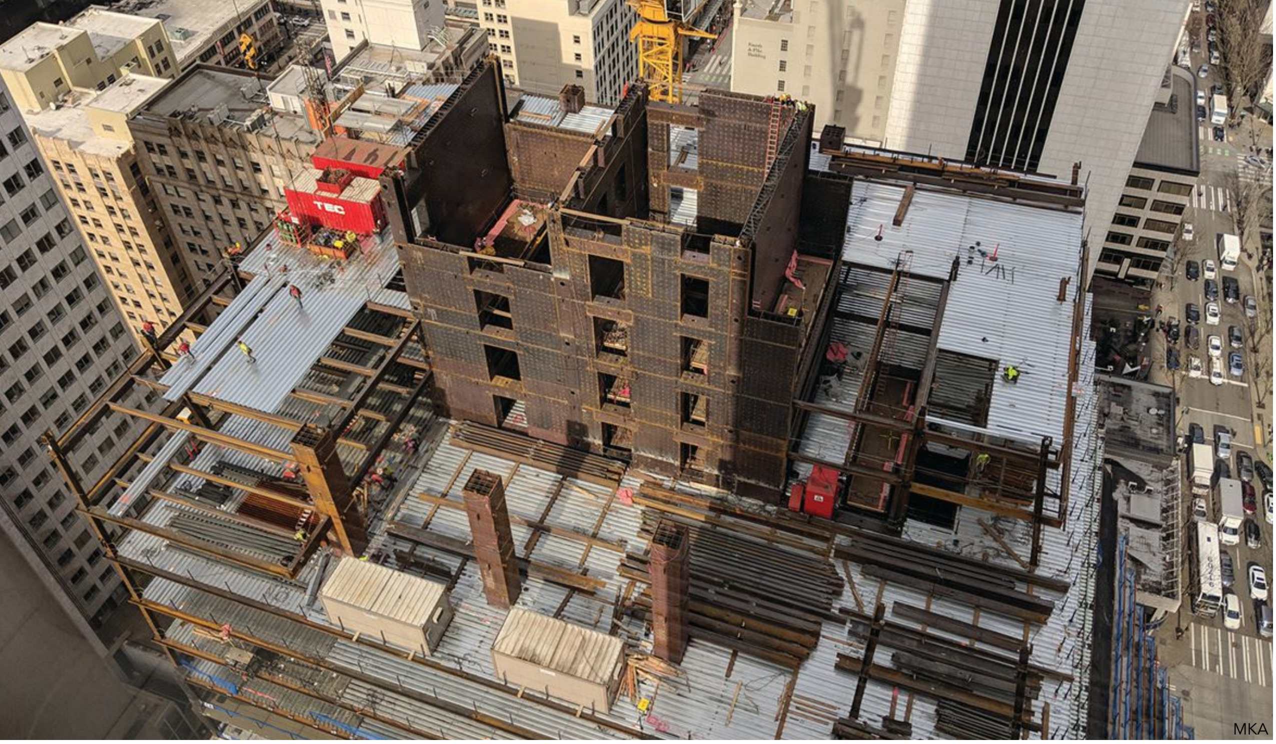
1. Steel prefabrication. More than 530 plates—each ½ in. thick, 30 ft to 40 ft wide, 14 ft tall, and weighing approximately 20 tons—were fabricated then preassembled in connected pairs 21 in. to 45 in. apart with 1-in.-diameter steel tie rods to form modules ready for site installation and concrete fill. The panels were fitted with openings for MEP services, penetrations for fire protection pipes, and connection materials for field-attached floor beams.
2. Module transportation placement. Once assembled, the modules were stacked onto trucks, transported to the construction site, hoisted into place, and field welded.
3. Filling the "sandwiches" with concrete. As the panels were erected, concrete was pumped into each module, resulting in a configuration much like an ice cream sandwich, with steel panel "cookies" on the outside and concrete "ice cream" filling inside.

In all, the SpeedCore approach lived up to its name, shortening the original 32-month construction schedule by ten months versus using a traditional core system. At the pace of four floors per week, erection occurred at a lightning-fast tempo compared to traditional cores (one floor every three to five days). In addition, implementing SpeedCore eliminated the challenges of expensive, time-consuming, and labor-intensive processes such as setting formwork, installing reinforcing steel, placing embedded plates, and the level-by-level concrete placement and curing associated with reinforced concrete cores found in most high-rise buildings.

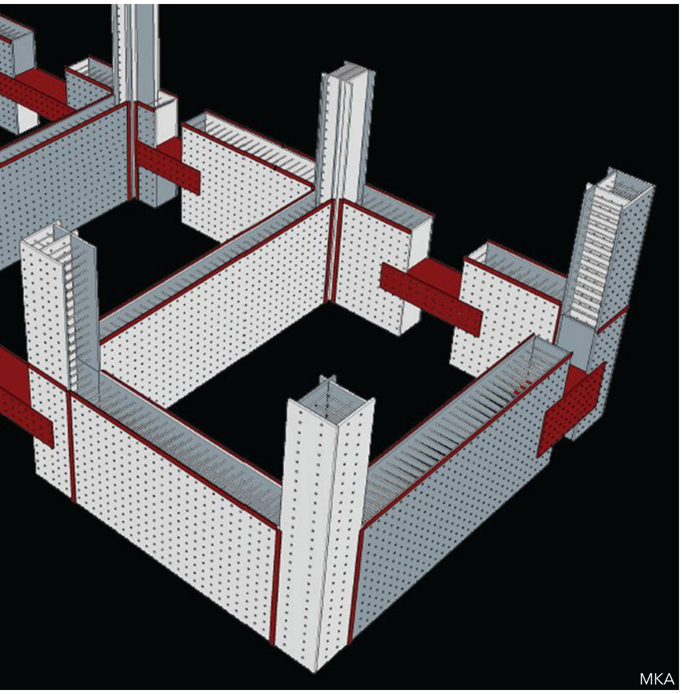
Completing Rainier Square ahead of schedule allowed the owner to save money in construction-loan carrying costs and general construction operating costs. Opening sooner provided an earlier revenue stream for the owner to lease office floors, retail spaces, and apartment units. If you visit Rainier Square today, you can witness the project team's pride in SpeedCore. Sections of the structural core's CF-CPSW panels have been left uncovered and exposed in different parts

Moris Moreno





MKA



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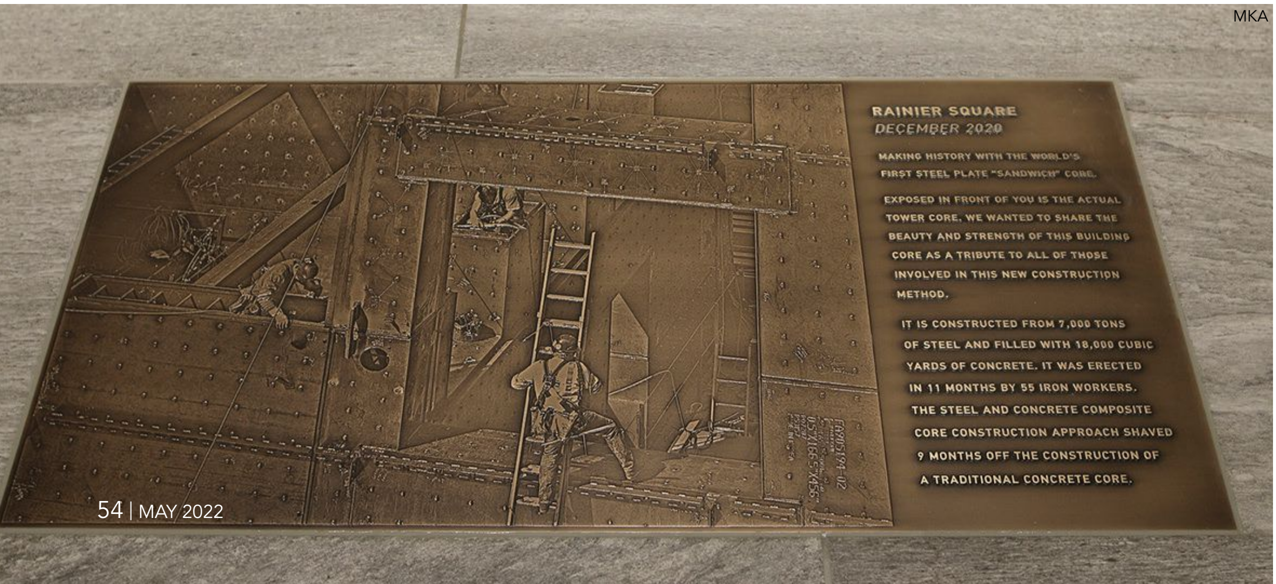

Tim Rice

of the lobby, allowing visitors to touch the raw steel plates and tie-rod welds, and read a bronze plaque to learn about SpeedCore's innovative nature. ■

Owner
Wright Runstad & Company

General Contractor
Lease Crutcher Lewis

Architect
NBBJ

Structural Engineer
Magnusson Klemencic Associates

MKA

Complementary Design

Rainier Square shares its site with Rainier Tower, a 40-story office building built in 1977 and designed by Minoru Yamasaki, one of the 20th century's most prominent architects. For this iconic tower, Yamasaki implemented a conspicuous 11-story windowless concrete pedestal that tapers and flares upward and outward like the stem of a wine glass—a safe and resilient structure, to be sure, but one that will forever draw double-takes from passersby in seismically active Seattle.

Given Rainier Tower's revered legacy and unique presence, Rainier Square was designed to preserve, enhance, and pay homage to the older high-rise—not compete with it—by creating a respectful yet visually stunning form that complements and sensitively maintains views and daylight access of Yamasaki's masterpiece.

This goal was achieved via sloping steel columns that afforded Rainier Square its unique, sweeping form. Instead of blocking out Rainier Tower, the new building's east façade curves upward, and the tower's floorplates gradually taper from roughly 34,000 sq. ft to 15,000 sq. ft between levels 4 and 38 to make room for—and lessen the visual impact on—Rainier Tower. Between levels 39 and 58 (the top floor), which house Rainier Square's luxury apartments, the tower's floor plates remain uniform at approximately 15,000 sq. ft per floor. In the end, Rainier Square's signature, curved façade—wide at its base but gradually slimming and tapering as it rises—complements Rainier Tower's own signature, curved pedestal—narrowest at street level but flaring outward and expanding as it rises.