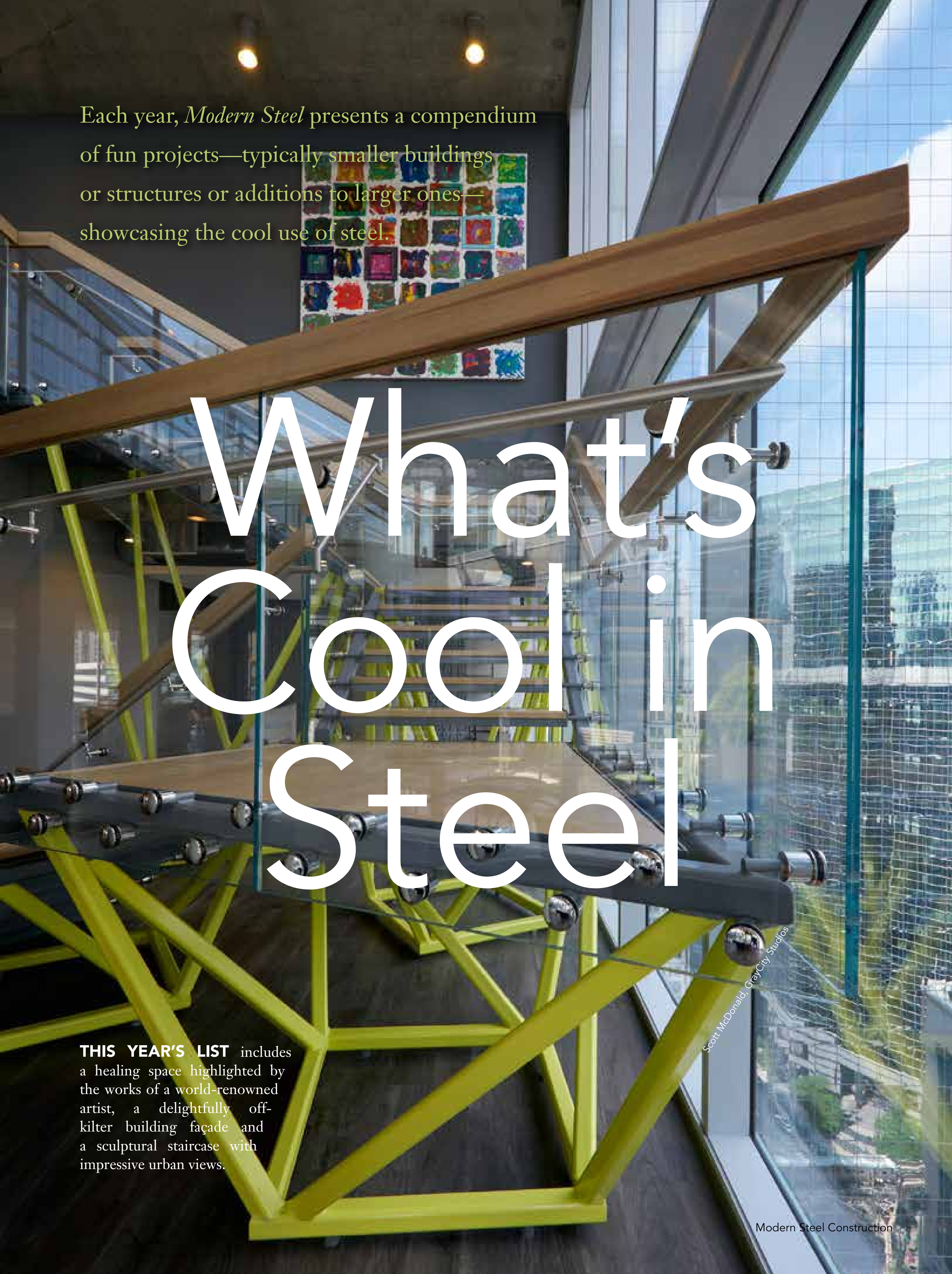


Each year, *Modern Steel* presents a compendium of fun projects—typically smaller buildings or structures or additions to larger ones—showcasing the cool use of steel.

What's Cool in Steel

Scott McDonald, GrayCity Studios

THIS YEAR'S LIST includes a healing space highlighted by the works of a world-renowned artist, a delightfully off-kilter building façade and a sculptural staircase with impressive urban views.

Cool Sanctuary

When the University of Nebraska Medical Center in Omaha opened the new Fred and Pamela Buffett Cancer Center last year, the facility's healing garden and sanctuary quickly became its signature space.

But it almost didn't work out that way as the space was not part of the original building design. It was only after construction was underway that a donor came forward with funding—and Tacoma, Wash.-based artist Dale Chihuly—to create a rooftop healing garden and sanctuary. The sanctuary is meant to be a quiet and contemplative space filled with Chihuly's characteristic bright, undulating glass sculptures, with its own sculptural form acting as an appropriate gallery of sorts. The sanctuary is a curving, free-formed shape, with none of the exterior walls aligning with columns or beams below.

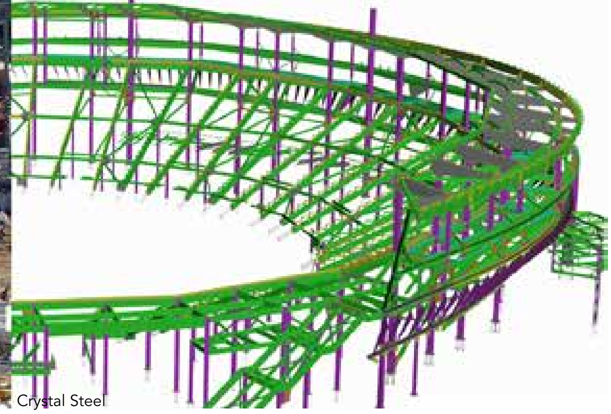
The roof is framed with metal roof deck on wide-flange steel beams, and around the perimeter of the roof is a continuous rolled hollow structural section (HSS). This beam supports the rounded edges of the roof deck, transfers gravity load to the columns below and also transfers wind load out of the columns into the roof diaphragm. (Curved steel was provided by AISC member bender-roller Max Weiss Company.)

Supporting the roof are five concrete columns located in the interior. And around the perimeter of the space, HSS columns double as mullions for the exterior glass walls. The perimeter columns are HSS4×4×$\frac{3}{8}$ at the one-story tall sections and HSS12×6×$\frac{5}{8}$ at the two-story sections. By using the mullions as load-bearing elements, the roof loads are more uniformly distributed over the concrete slab below. Minimizing column width maximized views to the exterior, and the columns were coated with intumescent paint and left exposed, matching their spacing to the width of the exterior wall glass panels. An additional, signature component is the large oculus that allows light into the interior of the space.

The design of the sanctuary started with hand-sketched floor plans from Mr. Chihuly that were converted into a Rhino model by HDR, which served as the project's architect and structural engineer. Once the Rhino model was approved by Chihuly, it was exported into Revit to create the geometry used for the construction documents. In addition, the coordinates of the columns were imported from the Rhino model into RAM Advanse to start the structural analysis model, then roof framing and loads were added to complete the analytical model.

The exterior walls of the sanctuary are constructed entirely of point-supported glass panels that are curved in plan. The steel fabrication model, created by AISC member and certified fabricator Drake-Williams Steel, Inc., was shared by the entire team to coordinate the location of the steel columns with the curved glass panels and the location of the point-supported connectors between the glass panels and the columns (steel erection was performed by AISC member and certified erector, Topping Out, Inc./Davis Erection). Due to tight tolerances as well as the curved plan, this coordination would have been very difficult to achieve without an electronic model.

The end result is a stunning piece of art, architecture and structure that provides a quiet oasis for patients and their families.



Crystal Steel

Craig Tracy, Vice President, WSP - Parsons Brinckerhoff

Cool Stadium

The US Open draws more than 700,000 tennis fans to the USTA Billie Jean King National Tennis Center in the Flushing neighborhood of Queens, N.Y., every year. While the two largest stadiums at the venue, Arthur Ashe Stadium and Louis Armstrong Stadium, seat approximately 24,000 and 14,000 fans, respectively, the new Grandstand Stadium, with a capacity of 8,000, is nothing to sniff at either. Designed to accommodate the increasing number of fans that flock to the annual tournament, the project presented formidable challenges to engineer WSP (which also designed Arthur Ashe) including geotechnical and seismic conditions at the site, limited construction space, financial feasibility and navigating the aesthetic features of the various proposed designs. In addition to the centerpiece Grandstand, 10 new courts were constructed for the South Campus portion of the project, which provides seating for an additional 8,000+ spectators along with sponsor booths and other amenities.

For the Grandstand portion of the project, the general design for Grandstand Stadium is an homage to the remaining structures from the 1964 New York World's Fair, which was located on the same Flushing Meadows–Corona Park site as the National Tennis Center. A major aesthetic goal of project architect Rossetti Architects was to create two non-concentric rings supported on the minimum possible number of columns, beams and braces in which the structural elements and their connections were showcased by being left exposed. The two rings form the inner and outer perimeter of the upper walkway, which runs all around the stadium, promoting constant circulation of visitors.

The superstructure of the new stadium is comprised of 14 independently stable, wedge-shaped segments separated by special expansion joints aimed at reducing self-restraint forces due to thermal expansion and differential settlements. Each segment is formed by three to nine bays rigidly connected by columns, perimeter beams, raker beams and framing elements supporting the perimeter walkway and cantilevered canopy.

An imaginative steel scheme was used to provide lateral stability for the superstructure. In the radial direction, raker beams were designed as dual-purpose members not only carrying the vertical loads associated with the stadia and spectators, but also serving as concentric braces for the columns supporting the segment. This solution allowed for the simplification of column base supports, which did not require moment connections. The lateral stability in the circumferential direction was provided by a combination of beams supporting the upper walkway and additional mid-story braces showcasing exposed pin-end connections.


Crystal Steel


Crystal Steel

Special loading demands of all sorts comprised a major challenge for the project. Hurricane-force winds, seismic events, swamp-like compressible soils and vibrations and sway due to human movement all needed to be addressed. In addition, remnants of foundation elements from not only the 1964 but also the 1939 World's Fair, which was held on the same site, further complicated the structural design of the new stadium. In contrast with the adjacent venues, shallow foundations were considered the most economical solution, provided that all supported structural members were designed to accommodate the intrinsic soil settlements.

The non-concentric rings supporting the main structure also served as the main support points for a series of curved hollow structural sections (HSS), labeled as ring beams, on the exterior (curving was performed by AISC member bender-roller WhiteFab, Inc.). The HSS in turn supported a vertical tensile fabric fascia covering the exterior of the stadium. At the ring levels, the forces from the fabric were then transferred from the HSS via a series of braces and one-directional slip joints to the main structural members (columns, rakers and bracing). At the uppermost level, the vertical fascia transformed into a high-tension canopy roof. Support for the tensile membrane canopy consisted of tapered box girders spanning between the non-concentric column rings with curved, fixed-end HSS framing between the tapered box girders serving as stabilizing members, as well as giving an interesting shape to each wedge of the roof. Special design software was used to determine the forces delivered to the structure in consideration of the highly non-linear behavior of the tensile membrane. Furthermore, special connection details for the attachment of the fabric to the rings and roof structure, and for the adjustment of its in-plane tension, were necessary. The HSS rings were especially difficult from a fabrication standpoint as they sloped and changed radius in plan. The fabric sub-frames were pin-connected to the curved HSS with more than a thousand ¾-in. connection plates. They were shop-attached to the rings at odd bevels and cants requiring elliptical pre-beveling prior to fit-up.

An interesting challenge was posed by the expansion joints in the superstructure, which required precise location and fabrication of slotted holes and seated connections to accommodate the required axial releases and their associated displacements and rotations. Recessed-nut pins with waterproof multipurpose grease were specified to reduce maintenance costs while increasing the service life of the structural connections. The steel was fabricated by AISC member and certified fabricator Crystal Steel Fabricators, Inc., which performed the very challenging connection design on a design-build basis and fabricated the complex connections with little to no rework.

Cool Crossing

Founded in 1951, the Oakwood School in North Hollywood, Calif., is a private K-12 institution whose campus has grown significantly over the years.

The campus includes a variety of buildings in a two-block area on both sides of Magnolia Boulevard, a major thoroughfare that feeds a major freeway just east of the school. Following a 2014 incident where three students were injured by a car collision while crossing the street, the school decided to build an elevated pedestrian bridge to increase the safety of its students and tie current and future planned campus buildings together programmatically and visually.

The public right-of-way to be traversed measures 90 ft, with a 10-ft zone on either side to accept any structure meeting the ground, resulting in a formidable span. The bridge also needed to maintain 17 ft of clearance above the street to accommodate truck traffic. In the near future, the bridge will be directly connected to new school buildings as part of the school's master plan. However, because the bridge was constructed first, it needed to be self-supporting vertically and laterally for the initial phase of the master plan. Temporary stair and elevator buildings buttress the bridge and serve as placeholders for future connections to school buildings.

Structurally, the basic bridge concept was that of a classic single-span pedestrian bridge: two parallel story-height trusses, the bottom chord supporting the floor and the upper chord the roof, with cantilevered columns on pile foundations on each end for support. The stair and elevator towers incorporate steel braced frames.

Complicating these forms, architect Brenda Levin, FAIA, of Levin and Associates and structural engineer Nabih Youssef Associates developed an ambitious architectural and structural vision for the truss construction. A butterfly roof with a different low point at each truss was implemented, creating a warped roof plane and varying the web height of the truss along the length (deepest at the ends of the bridge, smallest at the center). Novel rotated gusset plates and eccentric work points were used to "float" the diagonals up above the chords. Round truss diagonals were flush-welded to exposed gusset plates for seamless connections, and a constant angle for all truss diagonals was achieved by varying each truss bay size. A single, centered, minimally sized column limits the impact on pedestrian

Nathaniel Riley Photography

Plas-tal

Nathaniel Riley Photography

traffic and "floats" the bridge off the street. In addition, enhanced seismic and vibration performance was factored in to create a robust structure that would meet the future uses of the school without the need for eventual retrofits.

All elements were designed with future master plan building connections in mind, particularly at the foundations. Piles were detailed to be able to be excavated and exposed as freestanding columns when the basement of the future buildings are constructed. The bridge was designed as a Risk Category III/I=1.25 building to provide a potential egress route for planned future adjoining buildings that may have this same risk category, and the steel truss portion of the structure was designed to remain fully elastic under seismic events (R=1) to force ductility into the bridge columns. In addition, footfall-induced vibration was not to exceed AASHTO pedestrian bridge acceleration limits due to crowds of people walking on the bridge.

To meet these goals, the team collaborated intensely to coordinate bridge geometry and element sizes, as nearly all primary structural components are exposed and provide the architectural form of the bridge. Vibration criteria was determined early to be a key driver, as the unique bridge truss geometry made it sensitive to torsional modes of acceleration under foot traffic. Numerous bridge geometries and element sizes were modeled three-dimensionally and evaluated using a time-history analysis to represent people walking and running across the bridge and connecting stairs.

Demanding vibration and seismic performance of the bridge structure was ultimately achieved by introducing horizontal truss diaphragms into the floor and roof planes. These hidden trusses lace through the warped roof and sloped floor planes and allow the bridge to behave like a true closed-shape box, with the kind of strong torsional behavior delivered from tube steel and similar steel elements.

As part of the overall strategy to minimize the bridge span and reduce demands on the steel structure above, the concrete columns were pushed to within 4 in. of the property line, requiring pile cap foundations be designed for a very large eccentricity. To design the foundations, the pile cap and piles were 3D modeled with soil springs to capture the soil-structure interface of the piles.


Nathaniel Riley Photography

Early discussions with the Los Angeles Bureau of Engineering (the building official for the bridge) developed an agreement on appropriate design criteria for various components, with fully elastic seismic design being used for many elements—such as the eccentrically loaded "transfer" pile cap—to allow for pedestrian comfort and to give the school a robust bridge designed to exceed code requirements.

Pre-construction coordination with the contractor (MATT Construction) and steel fabricator and erector (AISC member fabricator Plas-Tal Manufacturing Company) allowed for early determination of shop and field fabrication components, as well as the decision to fully construct the bridge's steel frame in the shop and transport to the site whole, thus increasing dimensional control and overall quality.

These design decisions and processes allowed the bridge to be constructed successfully, achieving the architect's vision of a robust structure with delicate connections cutting an intriguing geometry across the sky over Magnolia Boulevard and providing a gateway to the school and the community.

Cool Entrance

A creative entrance now welcomes visitors to creative institution KANEKO.

Established in 1998 by international artist Jun Kaneko and his wife Ree, KANEKO is headquartered in three turn-of-the-century warehouses in the Old Market District of Omaha, with a vision of celebrating creativity and an overriding mission comprised of four major themes: design, ideas, performance and innovation.

The KANEKO Entrance Addition project (structural engineering by HDR) came about when 20 ft of city street became available (the same spot in which the original docks for the three Kaneko warehouses/galleries were located). With this "bonus" space, the designers were able to create a sheltered main entry into the gallery buildings.

The addition is a linear space that encourages visitors to circulate throughout the venue's atrium, opening access between the various gallery spaces and two different levels. At the same time, it provides open space for lectures and after-hours events with direct access to the entry—without having to open the entire facility.

The space has a high ceiling that showcases the existing structure, displaying the rustic brickwork and connecting the past with the present. At the far end of the addition, the structure houses the administrative offices of the gallery proprietors. The façade and appearance of the entry form a transparent filter toward KANEKO, which lights up like a lantern at night. Facing north and west, the glazed portion of the atrium is laid out in a striped pattern flowing the same way as the steel structure. With its expansive picture window framing out the bow truss gallery, the exhibitions inside are revealed, offering a welcome attraction for night strollers when the gallery is closed.

With its distinctive artistic expression, the addition was "born" by juxtaposing a 3° site slope against a 3° column/beam slope, for a total effect of 6° of variance. The three degrees of structural slope defines the building form and influences the design of the glass and foundation walls. As one climbs the stairs or works in the offics, light, transparent glass and the panelite enclosure create a varied field of visual experiences.

Copyright 2017 Dan Schwalm/HDR, Inc.

Copyright 2017 Dan Schwalm/HDR, Inc.

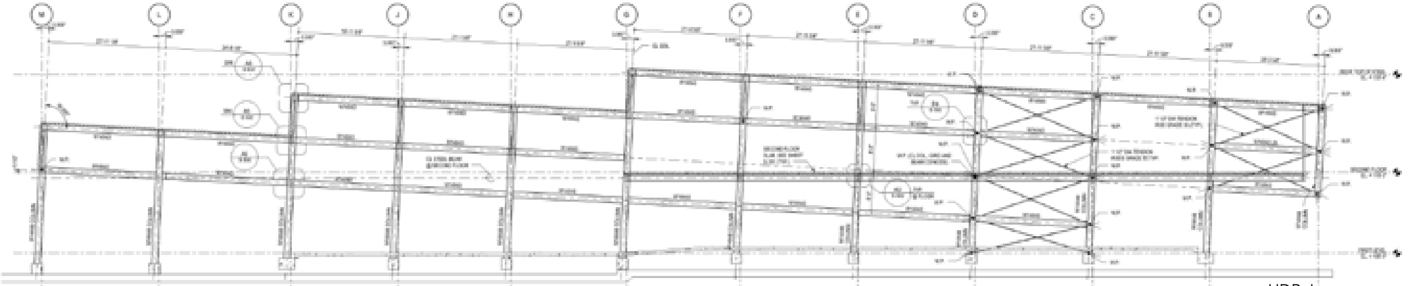
Copyright 2017 Dan Schwalm/HDR, Inc.

Courtesy of Kaneko Copyright 2016 Ben Semisch

Reinforcing the matter-of-fact architecture of the existing 19th century warehouse buildings, the structure continues a program and performance-driven appearance. The architectural expression for the addition presented the structural team with many unusual challenges, including the fact that the addition is only one bay wide with an interior and exterior sloping frame at 3°. The structural slope of the beams and columns created significant p-delta effects that had to be taken into account. The slope also presented problems with the gravity framing. One key component involved the sloped exterior beams, which do not align with the interior floor framing. This means that the interior floor framing only connects to the frames at one location per bay, occurring at the sloped columns.

The erector (AISC member and certified erector Topping Out, Inc./Davis Erection) had to consider this slope, applying a tighter tolerance to erection so as to maintain the consistent slope and to avoid visually unappealing variances in the steel. Additionally, multiple work points for the steel (to existing building connections) had to be maintained to transfer the addition loads to the existing structure.

Laterally, in the short direction, the new structure leans on the existing building. At the point where the structural frames tie into the existing structure, and due to the slope, the lateral point loads occur within the height of the existing concrete columns. To ensure the existing columns were not overloaded, supplemental hollow structural sections (HSS) were placed behind the ex-



HDR, Inc.

isting columns to transfer the lateral loads to the existing floor and roof diaphragms. Connection plates and anchor rods were designed to transmit lateral forces out of the frame, through the existing structure and into the HSS members. To avoid imparting load onto the existing structure, the anchor rods were double-nutted and placed in oversized holes.

AISC member and certified fabricator Drake-Williams Steel, Inc., served as the fabricator for the addition. With the steel frame being set outboard of the exterior curtain wall, several penetrations occur throughout the curtain wall to allow the outboard columns to support the load from the interior floors and roofs. This condition required that the exterior steel be thermally isolated from the interior support steel to eliminate the thermal bridging that would normally occur within the connections. As such, the connections through the curtain wall were designed to incorporate Fabreeka-TIM pads to maintain the structural integrity of the connections and to minimize any thermal loss between the respective steel elements.

Another innovative design feature is the cantilevered administrative area. Because the steel is outboard of the exterior wall on two sides, and architectural details do not allow the steel to pass through the curtain wall, the floor is hung from the roof steel using rods and clevises that mimic the rod bracing of the main structure. The desired aesthetics of exposed steel added to the detailing challenges of the structure. The architect's (HDR in collaboration with Mack Architects) desire to express the beam flanges and have them carry through the columns adds a simple but important feature to the structure's flow, forcing connections to be designed from both a functional and an aesthetic standpoint.


Ulf Wallin


Ulf Wallin


Ulf Wallin

Cool Skylight

The visually stunning George Peabody Library, located in Baltimore's historic Mount Vernon neighborhood, has been described as a "cathedral of books."

Opened in 1878, the research library's neo-Grec interior is often regarded as one of the most beautiful library spaces in the world. It features six tiers of stately cast-iron columns, decorative railings and classical embellishments touched with gold leaf.

The building is part of the Johns Hopkins University's Peabody Institute of Music. It houses approximately 300,000 books and rises 61 ft from its black-and-white marble floor to a massive glass laylight and decorative ceiling. A complex network of iron trusses above the laylight—virtually invisible to visitors below—spans the library space and supports the skylight above. When the modern hollow-core polycarbonate exterior skylight over the atrium of the library's Stack Room began to fail due to age and ultraviolet deterioration, general contractor Grunley Construction Company, Inc., was chosen to perform the renovation project to complete structural enhancements to the original cast iron trusses; install four new catwalks, including trolley fall protection systems; and fully replace the existing skylight system.

When working with a structure built in the 1800s, many elements, such as the dimensions and building materials, are not installed as they are shown on the original drawings. Grunley's extensive experience in historic preservation was instrumental in identifying and resolving design issues throughout this project. Early on, Grunley noted that the skylight design required welded connections. Given that the Peabody Library contains more than a quarter-million books, the project team suggested a custom design that integrated bolted structural systems instead of welded systems.

Designed by architect Ziger Snead and engineer 1200 Architectural Engineers, the custom double-pitch skylight was designed to account for structural loads, thermal movements and movements of the supporting structure. The system was designed with internal weep channels to catch any water that may infiltrate the system and allow the water to drain through a condensation track onto the sill plate. In addition, the use of clear annealed glazing units improved the thermal properties of the building while dramatically brightening the library. Grunley's recommendations to improve the design reduced costs, saved time on the delivery schedule and eliminated the potential risk associated with welding sparks in the immediate proximity of the books.

Work to replace the skylight took place in the main Peabody Stack Room. The historical integrity of the skylight was maintained by installing the structural steel support enhancements (fabricated and installed by AISC member and certified fabricator WSI, Inc./Washington Stair & Iron) without drilling holes for bolting or welding to the original trusses. An innovative technique referred to as "reversible" detailing, where connections between new and old trusses are made without drilled holes for bolts or welding between steel and iron, was implemented. Extreme precision was required as each new member of the truss was fabricated to its unique size.

One unique element of the enhancements was the creation of custom saddles that were installed at the outside knuckle of each truss. The saddles were designed with a bolt on the bottom, which applied pressure beneath the knuckle and relieved stress on the original truss. The saddles, like the rest of the enhancements, could not be welded to or drilled into the truss. Many of the bolts used for this project were slip-critical bolts that needed to be tested after installation to verify the proper torch was achieved.

Cool Club

The Boys and Girls Club of Rochester, N.Y., is a cornerstone in its neighborhood, providing a safe and educational, kid-friendly environment for local youth of all ages.

Located in a socially and economically depressed area, the Club creates a much-needed sanctuary for after-school activities and play. The new addition and renovations to the existing facility, designed by Pardi Partnership Architects, have allowed the Club to both expand and improve upon the services and programs it offers.

The major focal point of the design was a new glass skylight and atrium. This atrium is expressed on the exterior as an inviting new entrance and continues on into the interior, tying the new and existing buildings together along an atrium of natural light. During the daytime, the atrium is showcased internally, radiating sunlight throughout the facility, while at night it broadcasts itself to the exterior, drawing members in with its beacon-like glow.

The supporting structure of the atrium was also intended to be a visible design element. Widest at the main entrance, the decorative steel arches, fabricated by Ramar Steel Sales, Inc. (an AISC member and certified fabricator), decrease in size as one enters and continues further into the Club. Each steel arch is custom to its specific span, remaining at the same height along the north side, while adjusting to the narrowing width along the south—all the while maintaining a continuous 2/12 roof slope above. The resulting effect is repetitious, yet uniquely animated and playful—an overhead focal point well suited for the Club.

The new office walls, adjacent to the atrium, are purposely low, revealing the steel framing and metal roof deck above, while allowing natural light to reach further into the core of the facility. The large, open classroom type spaces of the addition also feature an exposed, open ceiling coupled with colorful vertical acoustic baffles to help with sound control. The overhead ductwork is painted an eye-catching orange, meant to attract attention and highlight the exposed characteristics throughout the facility.

Renovations to the existing part of the facility were meant to complement the new. Rooms were demolished and/or combined to create larger spaces, ceilings were removed and the existing roof structure was exposed. Directly north of the atrium, inside the existing building, a new game room was created. Drawing design inspiration from the new addition, the game room also features exposed steel, orange ducts and colorful sound baffles. This, in combination with custom new furniture installations and arrangements, has made the game room the true heart of the Club and brings a wow factor to members of all ages.


Pardi Partnership Architects

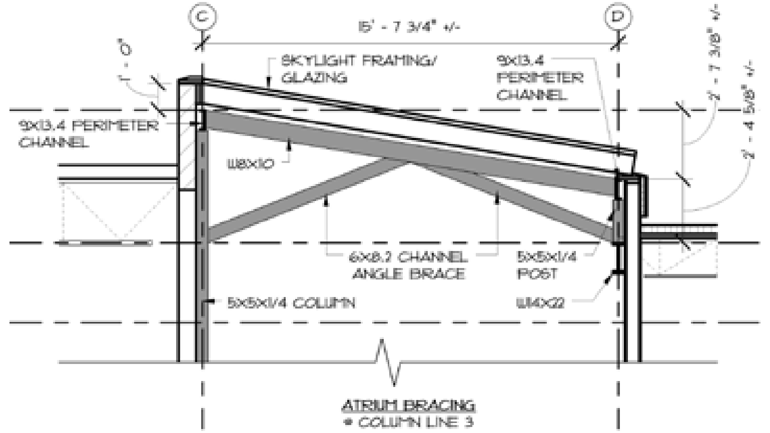

Sun Mountain Photography

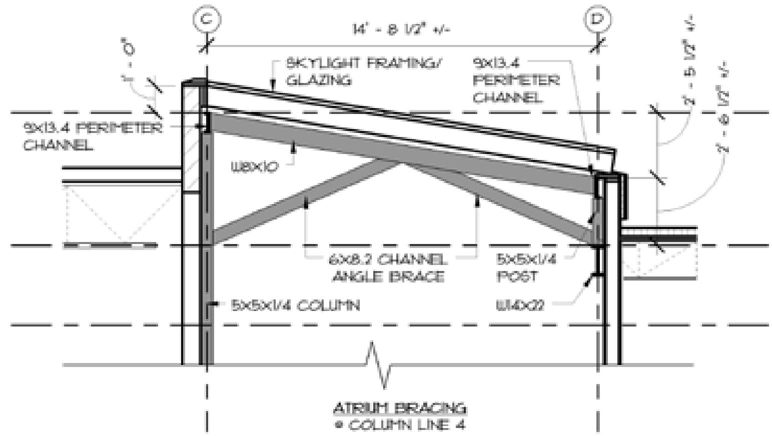
Pardi Partnership Architects

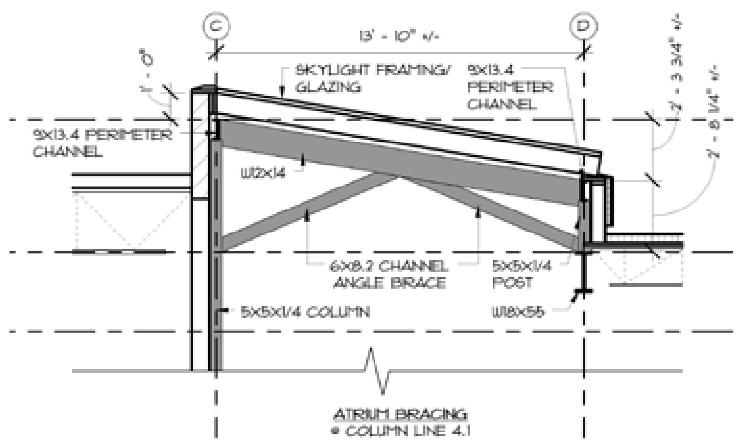


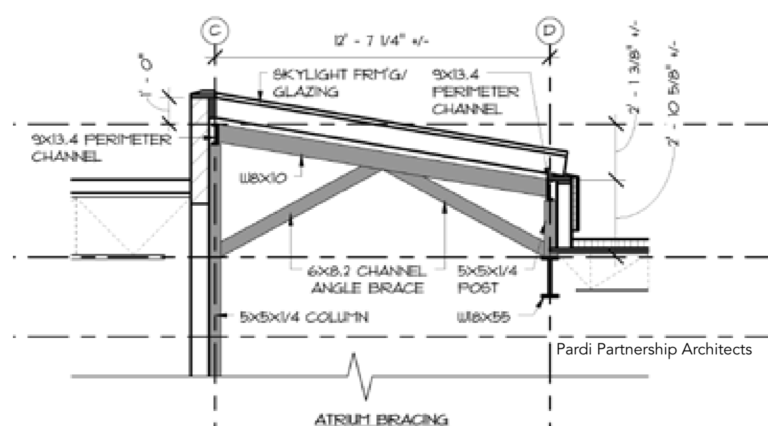
Pardi Partnership Architects


Pardi Partnership Architects



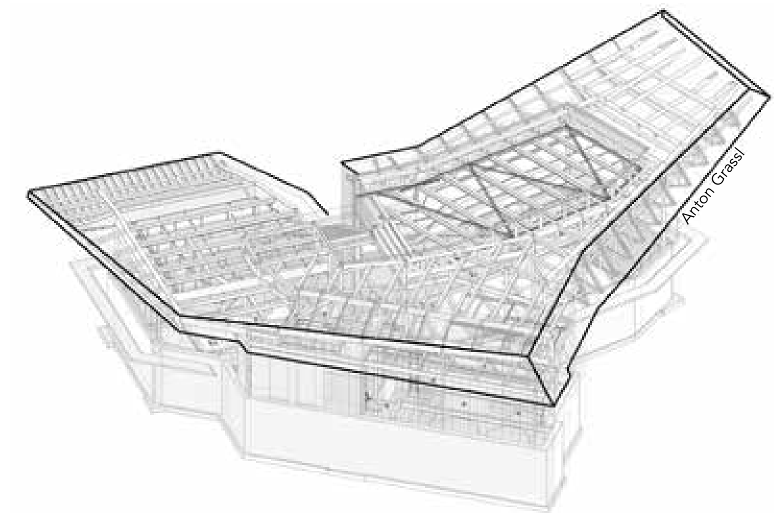






Pardi Partnership Architects

Anton Grassl



Anton Grassl

Anton Grassl

Anton Grassl

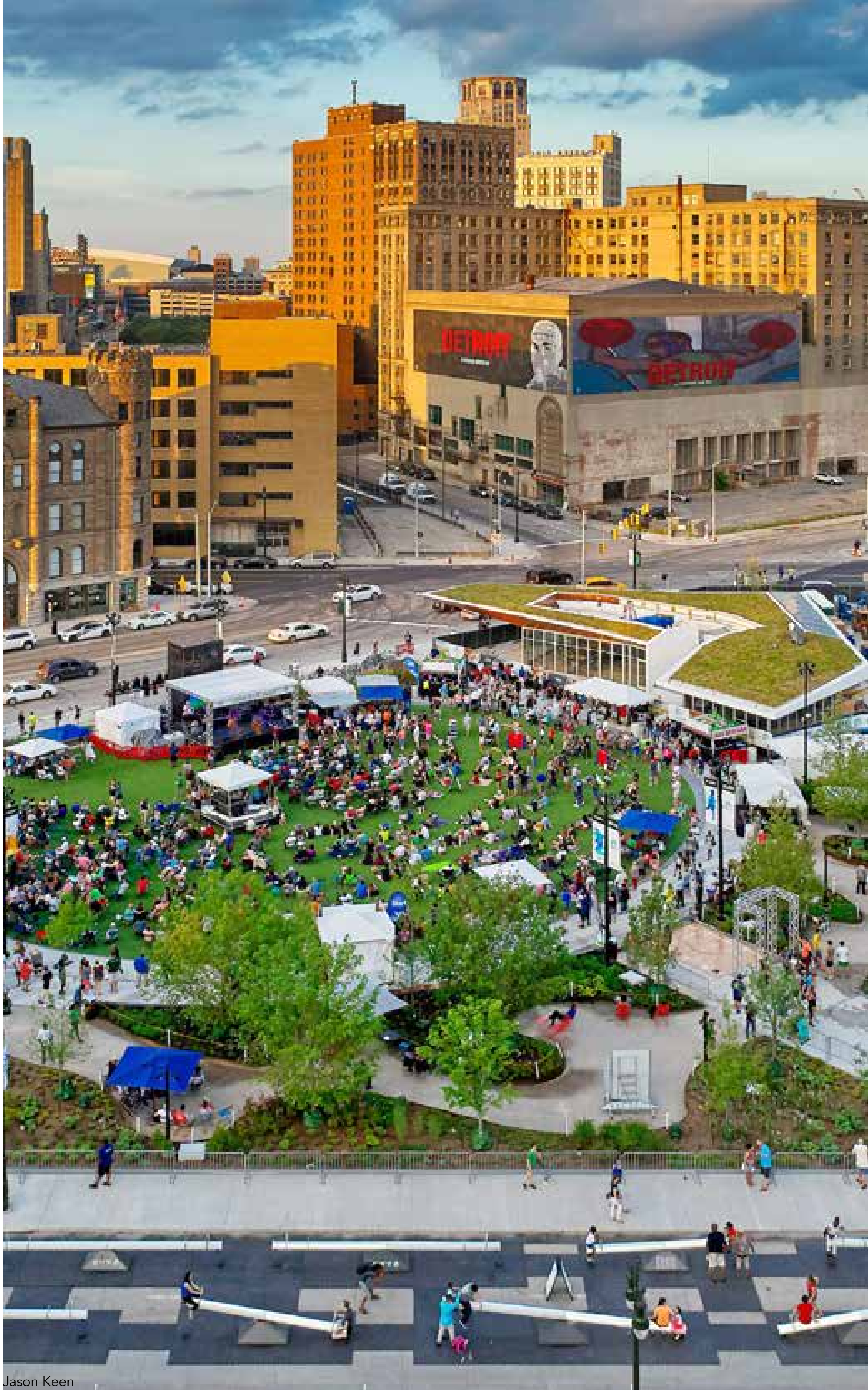
Cool Beacon

Situated along Grand River Avenue, Lumen at Beacon Park welcomes visitors to the heart of downtown Detroit.

This urban revitalization project and new public space was created to anchor the emerging neighborhood, spur economic development and provide a quality place for the community in the surging and vibrant downtown district. Central to its modern geometry are strong cantilevered roof forms gesturing towards the historic Grand Army of the Republic Building and the park's elliptical lawn, and a grand stair leading to a roof deck on axis with the historic Book Tower Building. Connections to the park landscape are further created with a green roof and also a sliding glass wall system that provides a flexible indoor-outdoor floor plan and options for restaurant seating, a farmers market, musical performances and a community meeting room. Forms, systems and details are meant to be evocative of the automotive legacy of Detroit.

Designed by architect Touloukian Touloukian, Inc., and structural engineer Studio NYL, the structural system incorporates steel in a series of complex interdisciplinary details. The

Touloukian Touloukian Inc.



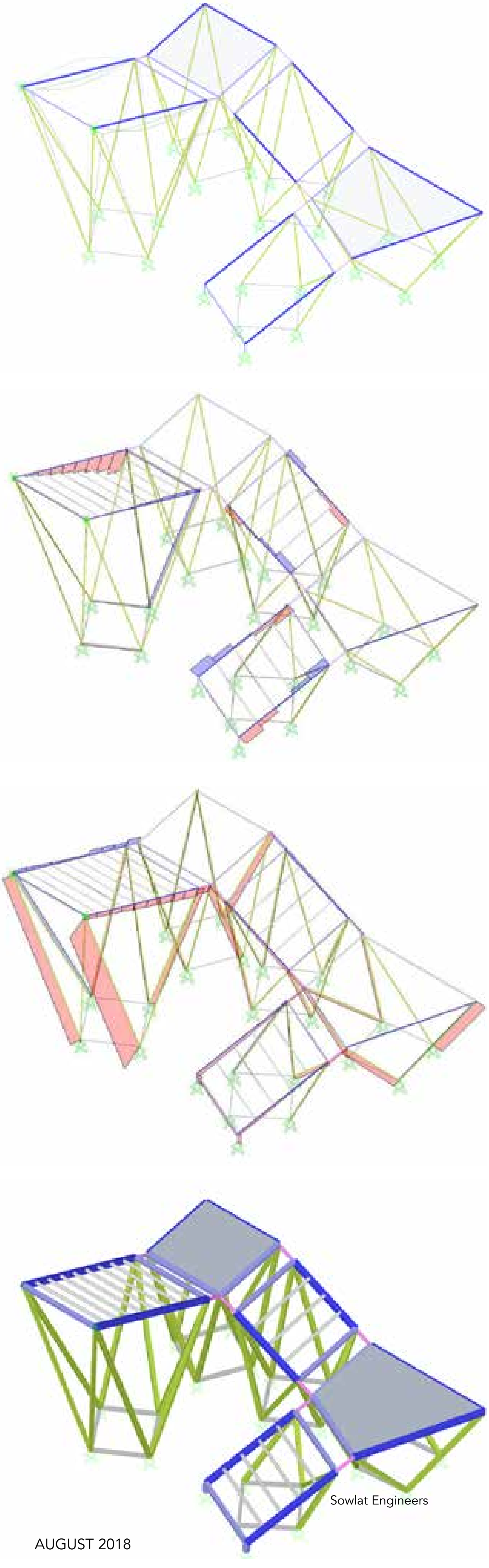
Jason Keen

main roof framing comprises two primary steel trusses that are concealed within the roof deck parapet walls. In addition to supporting the roof deck, steel outriggers, folding glass walls and fall-protection elements, these trusses and outriggers coordinate large penetrations of ductwork, piping, fire-protection and electrical systems.

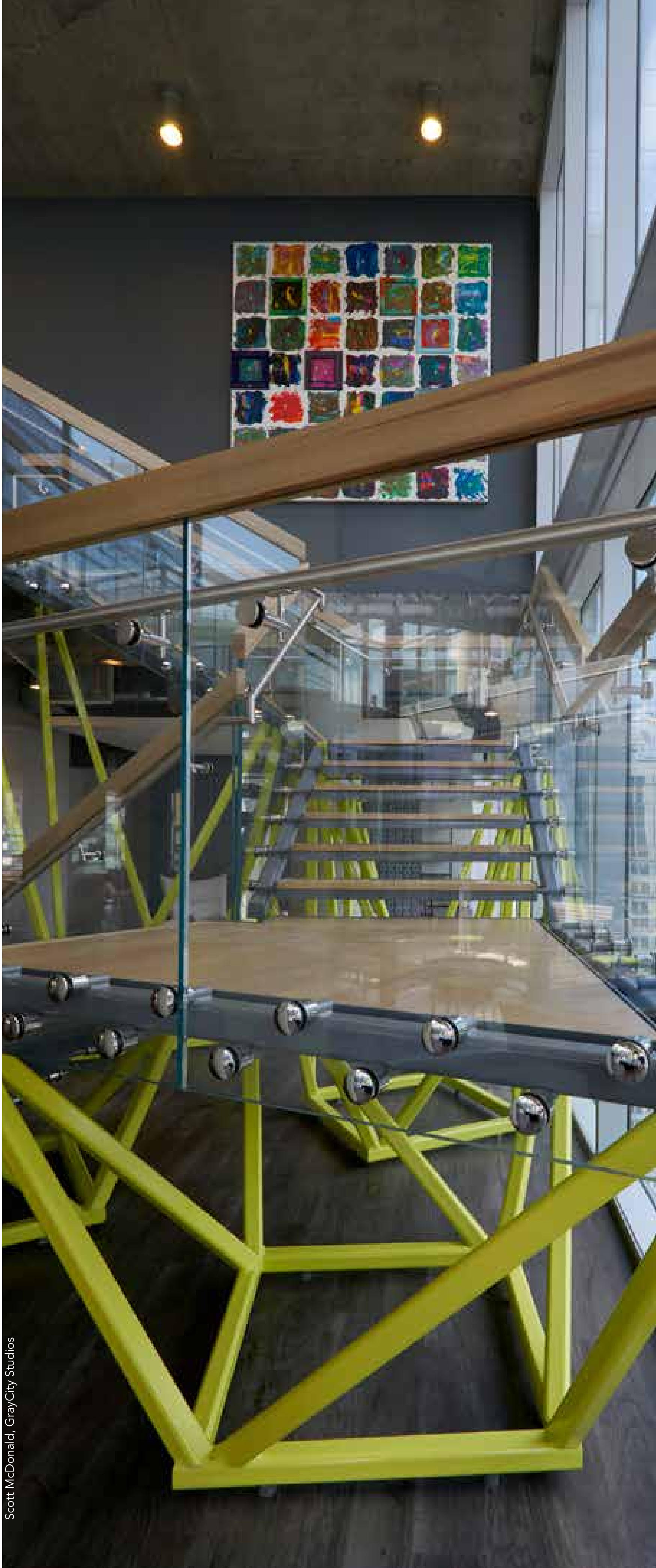
By tapering, upsetting and cantilevering beams and outriggers the project was able to achieve a 28-ft cantilever that terminates at an ACM panel fascia with a concealed built-up gutter and 6 in. of green roof medium.

Additional details included waterproofing the sloping concrete slab below the exterior grand stair. The shop-fabricated 20-ft-long by 8-ft-wide steel structure, made of steel plate stringers and horizontal channels, was set on steel plates above the waterproofing and concrete slab to allow for positive drainage.

Thermal performance was critical to the building's overall envelope and its pursuit of LEED Silver Certification. The team implemented thermal breaks between steel members that passed through the thermal envelope, filled hollow structural sections (HSS) with spray-foam insulation and over-sprayed steel and metal decks to reduce thermal transfer.



Sowlat Engineers



Scott McDonald, GrayCity Studios

Thomas Roszak, Thomas Roszak Architecture

Scott McDonald, GrayCity Studios

Scott McDonald, GrayCity Studios

Cool Stairs

In Chicago, a city renowned for its landmarks in modern high-rise and steel construction, the Linea Apartments building prominently features a steel staircase as a sculptural work of art in its own right.

Celebrating the social areas of the 33-story tower, the Linea Amenity Stair connects the 32nd and 33rd floor amenity levels of the 265-unit apartment building, contributing to the creation of a high-quality, desirable and distinctive residential development project that improves its urban Loop neighborhood. Integrated within the architecture of the building, the stair brings the sculptural and colorful presence, materiality and technology of the tower and its notable exterior bay window façade into its interior spaces to enhance the user experience.

Designed by architect Thomas Roszak Architecture and structural engineer Sowlat, the stair is comprised of six separate stringer and platform components placed next to each other to create a complete system that expresses the design intent of continuous, seamless, flowing space and a sense of connection. The freestanding support nature of the structures dramatically reduced field welding. Stringers are integrated as top members of freestanding structures and are discontinuous between adjacent freestanding structures to promote a modular construction approach. Structural continuity is carefully maintained using a three-pin connection between adjacent freestanding structures. The whole structure is made from steel plate, tube and rod, and the glass handrail is made with laminated glass panels attached with stainless steel clamps. The stair treads, platforms and top rails are laid with hickory wood.

Each freestanding structural component has eight vertical tubes supporting the platform or stringer run, and the top and bottom frame is twisted 30° for strength and visual delight. The rods supporting each tread hug the top and bottom of the tube and extend to hold the staggered glass clamps.

The inventive and striking use of color identifies structural elements, as well as endows the stair with its vibrancy and appeal. Structural platforms and stringer runs are painted gray to allow the twisted vertical elements painted in yellow to stand out in dramatic contrast. ■