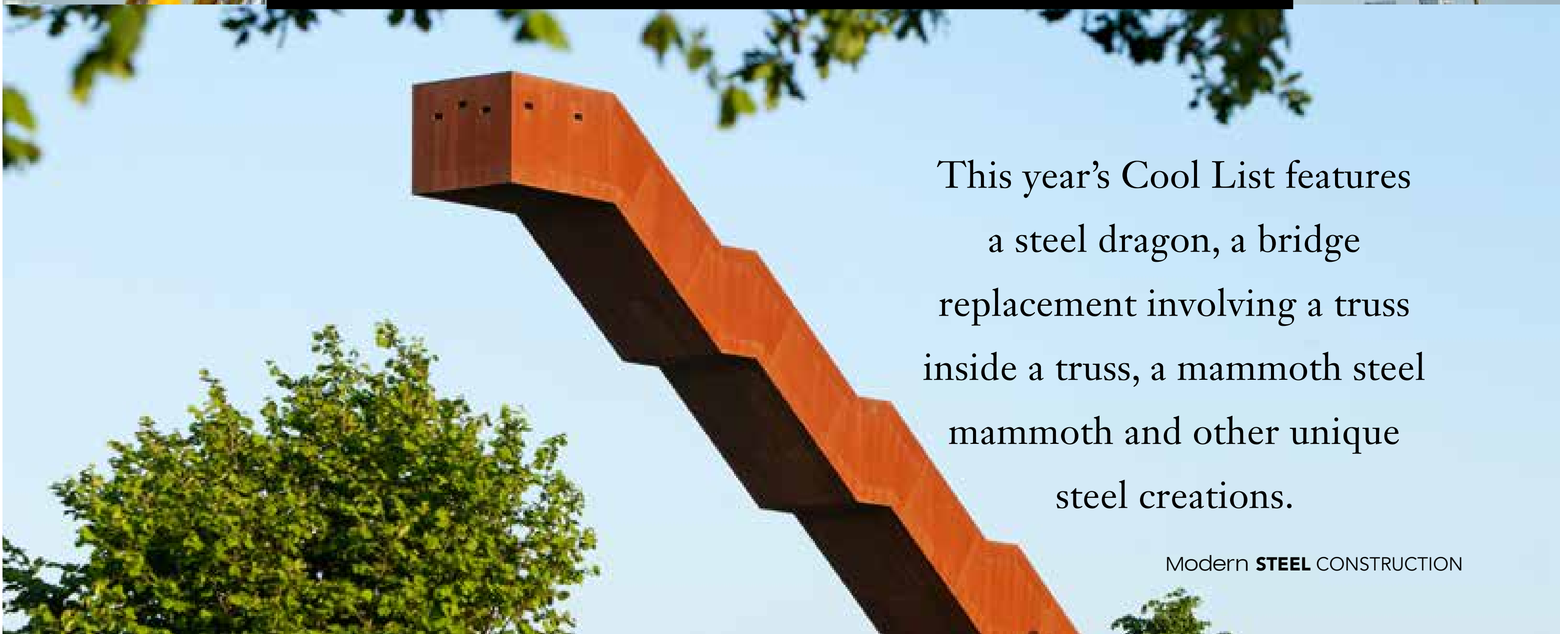
Each year, *Modern Steel* presents a compendium of fun projects showcasing the cool use of steel.

What's COOL in Steel



This year's Cool List features a steel dragon, a bridge replacement involving a truss inside a truss, a mammoth steel mammoth and other unique steel creations.

What's COOL in Steel

Cool Backbone

Enter the Dragon Bridge

A GOOD BRIDGE can take you over troubled water. But Da Nang's Dragon Bridge can do that and more.

The dragon, a symbol of power and nobility in Vietnam, serves as the steel support structure for the bridge over the Han River in this city of 1 million. Oh, and it also breathes fire and spouts water.

The project was designed by the team of Louis Berger and Ammann and Whitney and commissioned by the Da Nang People's Committee, who wanted a low-deck bridge that did not block scenic views while linking Da Nang to its burgeoning eastern sector and famed beach resorts across the river.

The suspension-design superstructure intersects with a flying dragon, its undulating back placed along the center line. The dragon has a suspended head and tail and a body covered in scales that spike upward along the spine.

The head represents the Ly Dynasty stone dragons and the tail a lotus flower, the national flower of Vietnam. Both are 15 m (49 ft) long by 9 m (29.5 ft) high. At 1,000 metric tonnes (1,102 U.S. tons) and 500 m (164 ft) long, the dragon holds the Guinness World Record as the largest steel dragon (a one-off recognition by Guinness).

Dragon Bridge has a single central "rib" with five steel tubes of constant diameter that carry the superstructure through "spider frames" and suspenders placed at 8-m (26-ft) intervals. The five curving steel tubes are bundled for structural integrity, and the rib supports 14-m-wide (46 ft) hybrid steel box girders in the center spans.

The box girders consist of a triple-cell steel box for the suspended portions and prestressed concrete twin-cell boxes for sections over the piers. Cantilevers extend from the box girders to complete the superstructure cross section for a total width of 35 m (115 ft).

Below the road deck of the 666-m-bridge (2,185 ft), box girders are made of structural steel for the suspended portions and prestressed concrete over the piers. Double-cantilever road decks carry six lanes and two pedestrian walkways.

To understand the behavior of the complex and unique structure, the design team created computer models to analyze the bridge as a whole. Models were also created to analyze the spider frames, suspenders, central arch rib, box girders, drilled piles and support piers. The analyses covered 14 potential load cases, including dead, live, wind, thermal, longitudinal wind and asymmetrical live loads. In all cases, the analyses were based on both local and U.S. standards.

The design team weighed several potential designs for the superstructure with safety in mind. One consideration was to erect the arch rib first, using tie-back cables, with steel girders erected from barges and supported on permanent hangers. Another idea was to erect long girder segments on isolated temporary bents followed by long preassembled arch rib segments supported by extending the temporary bents above the deck level. In all cases, the concrete deck was to be built after all steel was in place.

Day or night (illuminated by 15,000 LEDs) Dragon Bridge provides an essential river crossing and has created an instant icon and economic engine for Da Nang, drawing three million visitors per year to the city.

Tom Bonner

Tom Bonner

What's COOL in Steel

Cool Pool

Swimming in Tinseltown

Jim Pearson

Tom Bonner

Jim Pearson

HOLLYWOOD IS KNOWN FOR GLITZ. But one of its public pools was no longer A-list material.

Built in the early 1950s, the pool's bath house had become obsolete, and its ventilation and lighting systems were well past their prime. In addition, the pool was cracked and the water-filtration system had become inefficient. So the City of Los Angeles' Bureau of Engineering worked with Frank Webb Architects and Saiful Bouquet Structural Engineers, Inc., to design a new 5,000-sq.-ft structure on the northeast edge of an urban park. The project scope included a new bath house, a pool deck, a water slide with a reception pool and a new 125-ft × 75-ft pool with new filtration systems and equipment. The pool was widened by five yards, with the deep end in the middle, allowing the two shallow areas to be used for recreational swimmers and programming, and includes lap lanes, a 1-m diving board (which has been missing at the pool for approximately 30 years) and the water slide.

The structural design of the project had to satisfy opposing needs of the client and the architect. The bath house required highly durable solid walls for privacy but also needed to have the open feel of the outdoors. The solution was a structure with partial-height masonry walls and an exposed steel structure floating above, which was accomplished by cantilevering round HSS columns vertically through the masonry walls. The columns support an undulating frame of rectangular HSS steel, and bare metal deck, also exposed from below, was used for the roof. The exposed connections of intersecting steel members were fully welded to provide a clean look and seal the HSS from moisture. Galvanizing and high-performance paint protect the exposed steel and deck from the humid environment in the bath house.

Canted columns were used at the front entry to create a whimsical feel and match the sense of movement in the roof shape. Around the pool, cantilevered sun shade canopies were provided for small bleacher stands. The project also included the reconstruction of an existing water slide with all new structural steel supports.

The rise and fall of the steel roof framing, floating above the concrete masonry bath house, gives the feel of waves in the water of the pool. A void is created by the cantilever columns between the building and roof structure, which allows daylight to penetrate the entire interior and provides an outdoor feel to patrons.

U.S. Bridge

What's COOL in Steel

Cool Replacement

Truss within a Truss

BY KENT A. KAPUSTAR, PE, RICHLAND ENGINEERING LIMITED

Richland Engineering

U.S. Bridge

JUST OUTSIDE OF UPPER SANDUSKY, Ohio, a beautiful and historic valley cuts through the generally flat plains of Wyandot County. The valley holds the State Scenic Sandusky River and a museum within the Indian Mill, a grist mill built in 1861. In the middle of all of this was an aging, load-restricted truss bridge that crossed the Sandusky River.

The Indian Mill Bridge, a 177-ft single-span, single-lane, double-intersection Pratt through-truss, was originally constructed in 1913. The bridge became a languishing afterthought until it attracted the attention of the Wyandot County Engineer, Michael B. Kohl, PE. Given its presence in such a special location, Kohl initiated a project to investigate the structure's preservation. Richland Engineering Limited, a civil/structural firm from Mansfield, Ohio, was selected to prepare a study of various repair alternatives as well as prepare the final plans for the bridge's rehabilitation.

The rehabilitation plan included complete disassembly of the steel superstructure, replacement of the floor system including the timber strip deck, steel roadway stringers and floorbeams, replacement of deteriorated truss members and application of a protective coating for the steel.

Since the bridge crossed a scenic river, the project design team worked to minimize environmental impacts to the project's location. Based on past experience, the designers planned for the construction of a temporary work pad in the river, comprised of clean, non-erodible stone. And to avoid potential harm to the local mussel population, a survey and relocation was performed at the site to move over 100 bivalves out of the project area.

The project was awarded to fabricator U.S. Bridge (an NSBA member and certified fabricator), which had extensive experience with trusses and had worked closely with the Richland Engineering on several other truss rehabilitation projects. However, its approach to this project was radically different than previous ones: The team erected a 227-ft-long temporary truss (developed by U.S. Bridge and called a Liberty Truss) within the existing truss and used this temporary truss as a support to slide the existing one onto the east approach roadway. The bridge would then be disassembled or reassembled in pieces from the ground.

Analysis showed that the long-span truss was capable of carrying the bridge, provided the deck dead load was removed. U.S. Bridge first removed the dead load due to the asphalt surfacing on the bridge deck, then added temporary support frames. The existing wood deck was left on the bridge a little while longer to provide access for equipment installing the frames and to roll the Liberty Truss across. After the truss was in place and raised into position, but prior to lifting, U.S. Bridge removed the wood deck and 70% of the stringers, then lifted both the Liberty Truss and the (now) lighter existing truss.

The removal and re-erection concept was not only innovative, but also critical to the project's success. By not having to work in the Sandusky River, the team avoided delays and potential catastrophe during construction. Throughout the course of the project, the Sandusky River experienced several floods, which would have invariably precluded work in the river until the waters had receded and likely would have washed out any stone work platform constructed in the river. Had a flood hit while the Indian Mill bridge was supported by temporary columns in the river, the damage to the bridge may have been devastating.

With the bridge steel members transported back to its shop, U.S. Bridge set about fabricating new steel to replace deteriorated members. New steel members included all roadway stringers and floor beams, truss diagonal and lower chord eye bars and truss pins and bearings. The box-shaped truss top chords, end posts and verticals and original latticed portal and sway bracing were preserved.

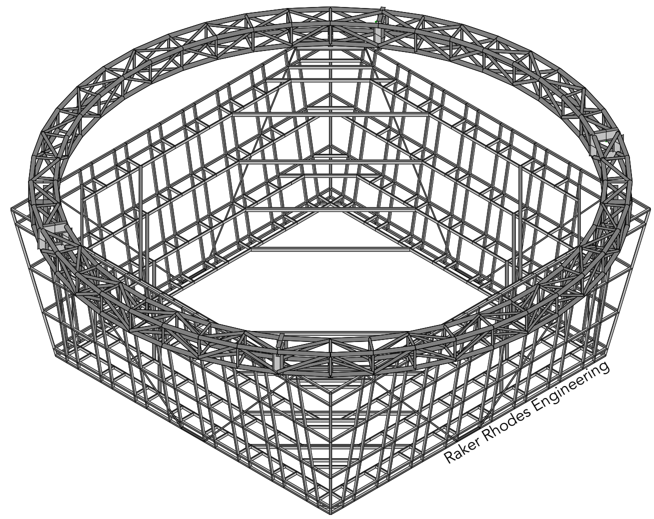
The new and existing steel components received a hot-dip galvanized coating for corrosion protection, and the bridge was re-erected using the Liberty Truss in a manner similar to what was used in the disassembly.

U.S. Bridge

Richland Engineering

Richland Engineering

Bristol Motor Speedway



Raker Rhodes Engineering

What's COOL in Steel

Cool TV

A Screen of Colossal Proportions

BY JACOB PHIPPS, PE, RAKER RHODES ENGINEERING, LLC

Bristol Motor Speedway

NASCAR TRACKS ARE SOME of the largest sporting venues on the planet—so naturally, one of them is home to the world's largest outdoor center-hung videoboard.

Bristol Motor Speedway in Bristol, Tenn., gets those bragging rights with its new Colossus TV. Perhaps somewhat ironically, it wasn't racing that prompted the need for such a monstrous TV, but rather football. Next month, the iconic NASCAR venue will host the Battle at Bristol, which matches the University of Tennessee Volunteers against the Virginia Tech Hokies and is expected to be the largest college football game in history in terms of attendance (the venue is planning for an attendance in excess of 160,000). In order to accommodate a football field, the facility's existing pylon-style scoreboard at midfield needed to be removed. While the game was the catalyst for Colossus TV, it will remain as a permanent fixture to provide a unique spectating attraction for future events at Bristol.

The TV is suspended from four cable-stayed, galvanized steel towers that range in height from 189 ft to 221 ft. The towers are anchored by 4-in.-diameter structural strand cable backstays, grouted micropile concrete foundations and structural cable connectors. The videoboard display has four faces, each one composed of 240 individual LED panels that are stitched together, creating a 63-ft-wide, 30-ft-tall display. A 60-ft-diameter ring of LED panels (6 ft in height) is hung below the main videoboards.

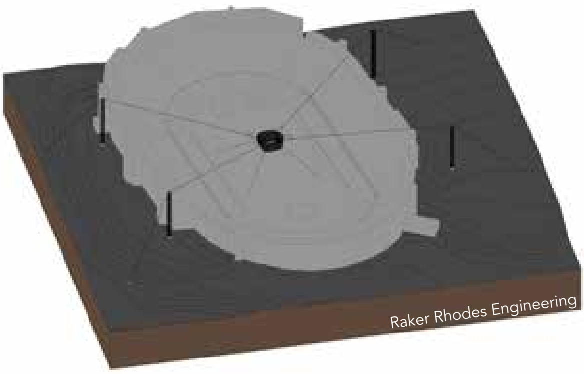
The videoboards feature over 20 million pixels, providing brilliant clarity and brightness to one of the largest sporting venues in the country. Since the videoboard clears the infield by over 100 ft (even exceeding the clearance of the mammoth video display at AT&T Stadium in Arlington, Texas), it is able to accommodate football field functionality (think high punts and kicks). The clearance is also high enough for improved sightlines to all portions of the famous short-track speedway, and the screens are demountable and leased to other venues around the country when not in use.

A hoist system raises and lowers the videoboard faces. The screens are supported by a galvanized steel framework, nicknamed the gondola, which consists primarily of rectangular HSS. The gondola has four levels of catwalks around its internal perimeter to access and maintain the videoboard panels and electrical systems. It is supported by a galvanized steel halo truss, made entirely of HSS pipe shapes, which is nearly 100 ft in diameter and has two top chords, two bottom chords and horizontal and vertical web members. The halo is suspended from the four towers by 3½-in.-diameter cable strands, each approximately 600 ft in length. Colossus TV is tethered to the infield by additional cable braces and 26-ft-tall masts made of HSS. The steel masts are founded by concrete drilled piers, and the entire structural system contains over 600 tons of structural steel fabricated by Superior Steel, Inc. (an AISC member and advanced certified steel erector).

Bristol Motor Speedway


Bristol Motor Speedway


Bristol Motor Speedway

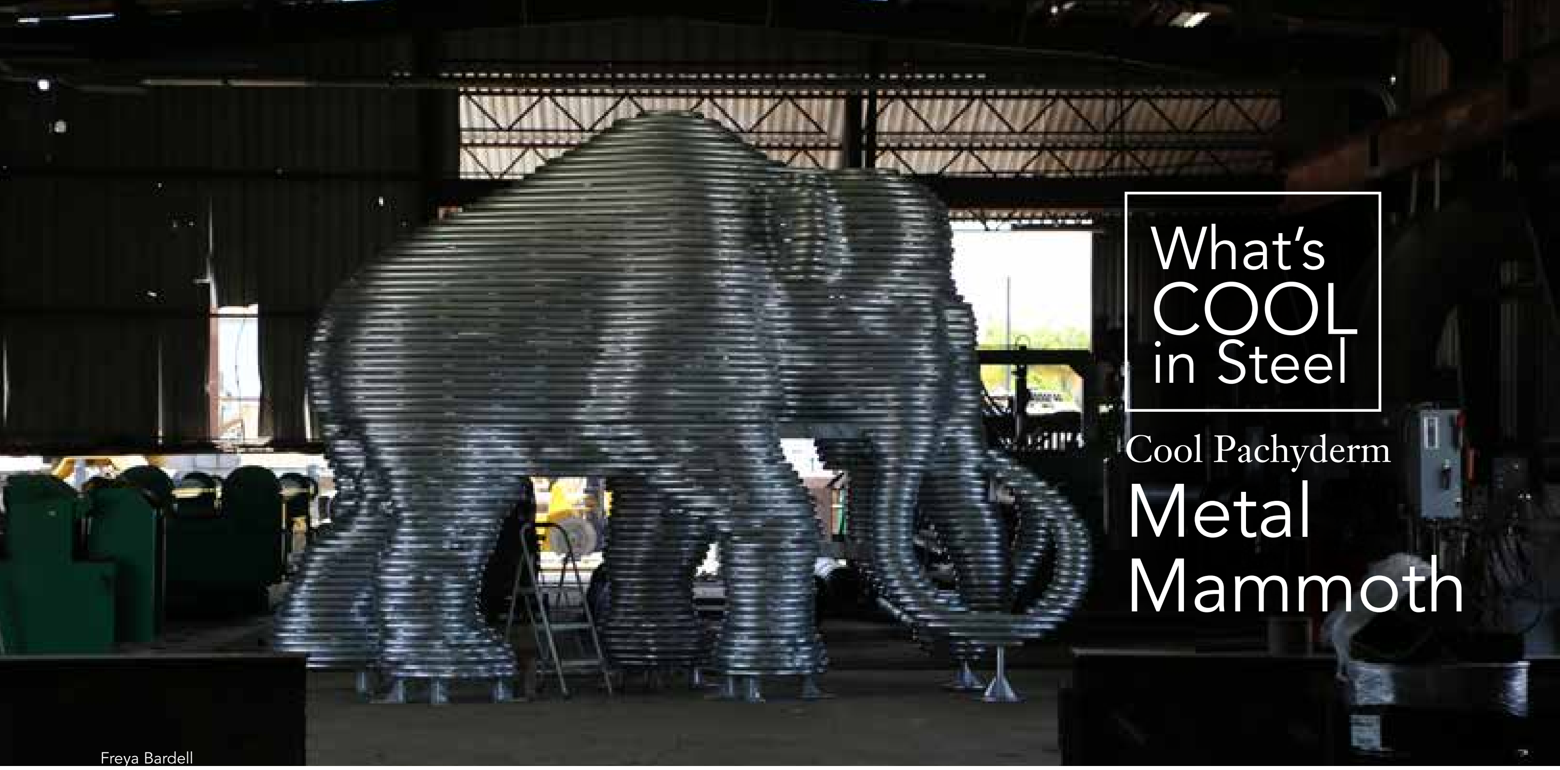

Raker Rhodes Engineering


Bristol Motor Speedway

The towers were shop-fabricated in 42-ft sections and spliced together in the field. Once the towers were erected, the backstay cables were installed and pretensioned to adequately reduce cable sag. This pretensioning pulled the tops of the towers back several inches in preparation to support the massive center-hung halo. Due to the length and weight of the main suspension cables, and because they had to be erected over existing infrastructure (skyboxes, lights, bleachers, fencing, etc.), the erector devised a strategy to temporarily hang the cables in position prior to the halo being lifted into place. The solution was to string temporary messenger cables from tower to tower in both directions. A tensioning wench was placed at the base of each tower so the messenger cable could travel up and over a tower and span approximately 1,200 ft to 1,300 ft to the top of the diagonal tower and down to the wench at the tower base. The main structural strand cables could then be lifted and temporarily hung in preparation to support the halo.

To facilitate shipping and galvanization of the large diameter halo, it was shop-fabricated in six arc sections, transported to a hot-dip galvanizer, delivered to the speedway and spliced together with bolted connections on the ground directly below the intersecting messenger cables. After hanging the structural strand cables, two lattice boom cranes could then lift the halo a vertical distance of 160 ft to where the final cable connections could be made. The messenger cables and cranes then transferred the halo onto the suspension cables, towers and backstay cables, and cable tensions and lateral tower deflections were monitored throughout erection to verify the system's load-distribution behavior and specified design limits.

Following halo erection, the four-sided gondola structure was assembled on the infield. The gondola assembly took place a safe distance away from the overhead halo and suspension cables to eliminate potential conflicts with cranes working to assemble the gondola. Once assembled, a slide-beam system was used to move the 75-ton gondola into position directly below the halo. Again, the towers were pulled back several inches by tensioning the backstay cables in preparation to support the massive gondola. Seven cranes then worked to lift and connect the gondola to the halo with heavy pin connections. Once pinned, the cranes then transferred the gondola load to the suspension system. The center-hung system was then levelled using adjustable cable sockets provided at the halo connections. Finally, the videoboard screens and tethering cables were installed.



Freya Bardell

What's COOL in Steel

Cool Pachyderm Metal Mammoth

Freya Bardell

Freya Bardell

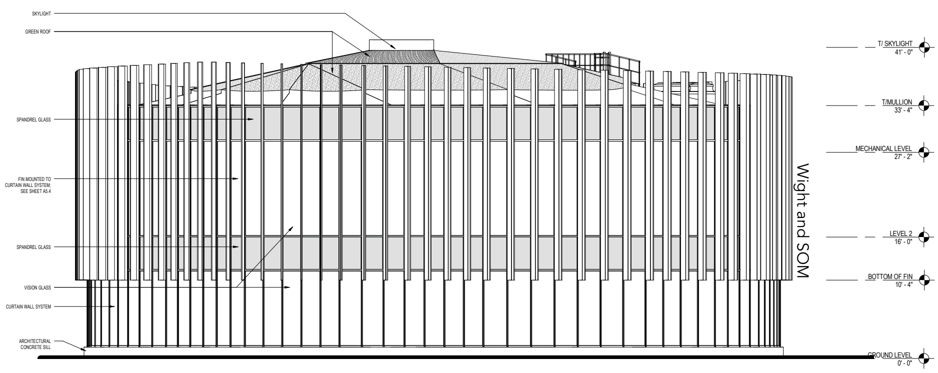
Freya Bardell

WANT TO SEE a mammoth in person?

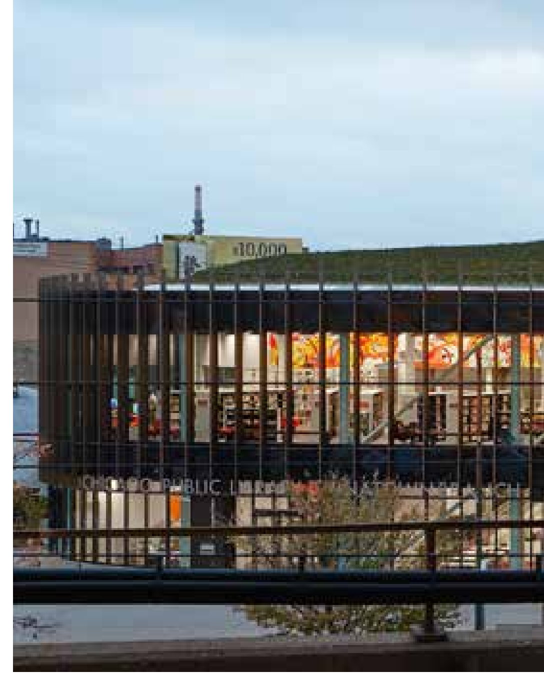
Well you can't. They're extinct. But you can see the next best thing—a life-size steel version—in San Jose, Calif.

In July 2005, a San Jose resident took a walk with his dog along the flood channel of the Guadalupe River, the Lower Guadalupe Trail, just north of the San Jose Airport. It was here that the skeleton and tusks of a mammoth were discovered among the eroding banks of the river. The steel version, named "Lupe" and standing on the same site, was inspired by this discovery and serves as an entry point to the trail and a reminder that these mighty mammals once roamed the Santa Clara valley.

Commissioned by the San Jose Public Art Program and the Trail Program, the sculpture was designed by Freyja Bardell and Brian Howe of Greenmeme Studio, with structural design done by CM Peck Architecture and Engineering and Andrew Nasser Structural Engineer. The designers chose to stack bent steel pipe into a topographical animal form suggestive of geological stratum that the mammoth was buried in. Lupe is comprised of 78 layers of steel pipe (bent by AISC associate member Paramount Roll and Forming), stacked and welded to form a 1:1 scale adult Columbian mammoth.



Wight and SOM



What's COOL in Steel

Cool Read

Light and Enlightening

BY ELISA KHO, SE, AND CAROL DRUCKER, SE, PE, PENG, DRUCKER ZAJDEL STRUCTURAL ENGINEERS

Jon Miller/Hedrich Blessing

Andrew Haas/DZSE

IN A CHICAGO NEIGHBORHOOD known for colorful facades with unique flair, it was only proper for a new library to buck the stylistic trends of its more staid contemporaries.

Led by Wight and Company in collaboration with Skidmore, Owings and Merrill (SOM) and Drucker Zajdel Structural Engineers (DZSE), the library's design-build team sought to create a modern design that would stand as a new icon in the area. The new \$9.6 million, 16,370-sq.-ft branch library serves as a civic, educational and social hub for the Chinatown neighborhood. The exterior glass curtain wall creates an image of a glowing lantern at night while also providing plenty of natural light during the day. In addition, the building is ringed with 16-ft-tall rectangular aluminum panels that provide solar shading.

The team considered both steel and glue-laminated timber beams during the initial design phase of the curving, triangular two-story building that subtly reflects angle of the intersection where it sits. But given the demanding load requirements associated with a library, wood beams would have been heavier and bulkier than steel beams, resulting in a less economical option. Plus, steel was determined to be a more sustainable option when measured on a whole-building life-cycle basis. McFarlane Mfg. Company, Inc. (an AISC member) was chosen to fabricate the 98 tons of steel.

The building's interior space radiates from a central atrium, and the main structural beams are similarly arranged on a radius. Round hollow structural sections (HSS) columns provide a clean surface where several beams connect into a single point. The round columns (typically HSS10.75×0.375) also facilitate and simplify the non-orthogonal lateral bracing connections. To satisfy fire-resistance requirements, they are Fire-Trol columns, which are prefabricated, fireproofed units consisting of a load-bearing steel column encased in an insulating material that is permanently protected by an outer non-load-bearing steel shell. An option to use precast concrete columns was considered early on but promptly dismissed due to a longer lead time, heavier sections, larger

Jon Miller/Hedrich Blessing

Jon Miller/Hedrich Blessing

Jon Miller/Hedrich Blessing

footing sizes, more difficult beam connections and the resulting increase in project cost.

Smaller HSS round sections are used as bracing members in order to create a more uniform appearance between the columns and lateral bracing. The braces are strategically located at the exterior bays of the triangular building, which resulted in an unobstructed and flexible interior. Final column and brace sections were selected to be as small as possible for aesthetic reasons as well as structural efficiency. DZSE drew on extensive experience in connection design to select columns capable of resisting local effects at beam and brace connections without the need for stiffeners or doublers.

Cool Hybrid

A Museum that Amazes

BY REB HAIZLIP, HAIZLIP STUDIO

Jeffrey Jacobs

Ken Petersen

Ken Petersen

WHO SAYS AN ART museum can't be hands-on?

Planned as an addition to the acclaimed Crystal Bridges Museum of American Art in Bentonville, Ark., the Scott Family Amazeum is a 50,000-sq.-ft discovery museum dedicated to family learning experiences. The building takes its cues of form and materials from Crystal Bridges and its use of exposed steel and concrete, curved curtain wall and zinc metal cladding.

The museum is primarily a one-story building with four community faces, each of which has different design attributes. The expansive south facade of the museum overlooks a large outdoor discovery play area and features a simply detailed steel and cedar pergola structure to soften the transition between the indoors and outdoors. The east facade faces a busy thoroughfare and introduces the building to the community. The north facade greets church visitors while the west facade welcomes visitors to the main entrance from the parking lot.

Both the owner and the architect, Haizlip Studio, expressed a desire for the building connections to be visible wherever possible. Exposed steel was used so that these connections were bare, lean and muscular, allowing visitors to understand the physicality of the building and how it was built.

The building connections are most evident at the lobby entrance, where the roof canopy above opens wide to welcome visitors into the museum lobby. The HSS12.75 round columns support a composite structure made of laminated wood beams. The lobby and exhibit hall feature curved glue-laminated timber beams and a wood deck supported by exposed steel columns. The steel attachment between these two systems highlights the connection between the two materials.

Throughout the exhibit hall, visitors can see many instances of exposed steel in the building architecture, as well as in the interactive learning exhibits that focus on technology, logistics, industry and creative play. The exhibit hall is full of modern industry and even has a full-sized semi-truck cab, a shipping container repurposed as a bridge and supported by an exposed steel frame and a beautifully complex tree-climbing experience made of formed plywood platforms mounted on a large steel structure (the project's steel was fabricated by AISC member and certified fabricator All Steel Construction). From the raw, exposed state of the building construction to the opportunities to work with machines, materials and tools in the tinkering lab, visitors have a sense of how different materials work together to form a new composite whole.


Ken Petersen

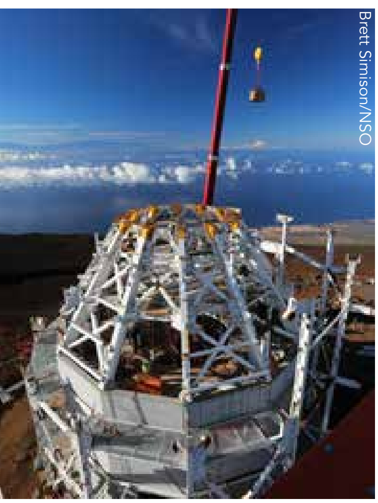

Ken Petersen


Jeffrey Jacobs

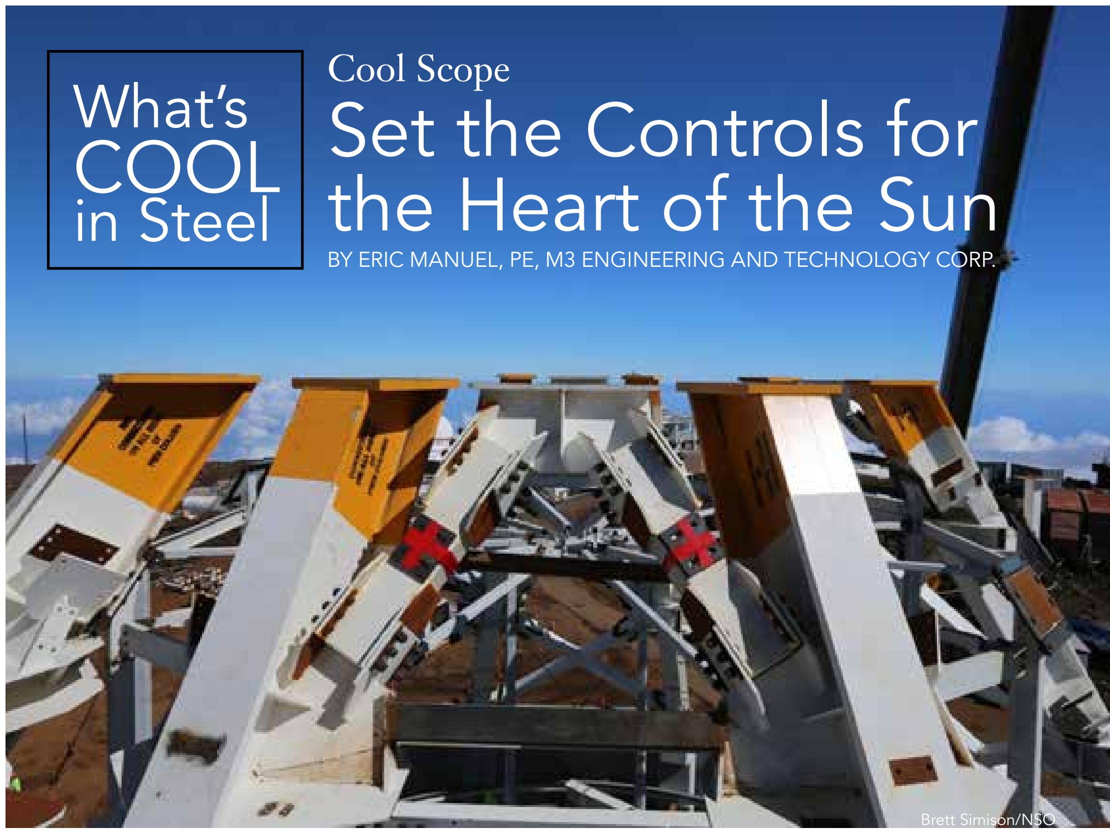
Brett Simison/NSO

Brett Simison/NSO

Brett Simison/NSO



Brett Simison/NSO



What's COOL in Steel

Cool Scope

Set the Controls for the Heart of the Sun

BY ERIC MANUEL, PE, M3 ENGINEERING AND TECHNOLOGY CORP.

Brett Simison/NSO

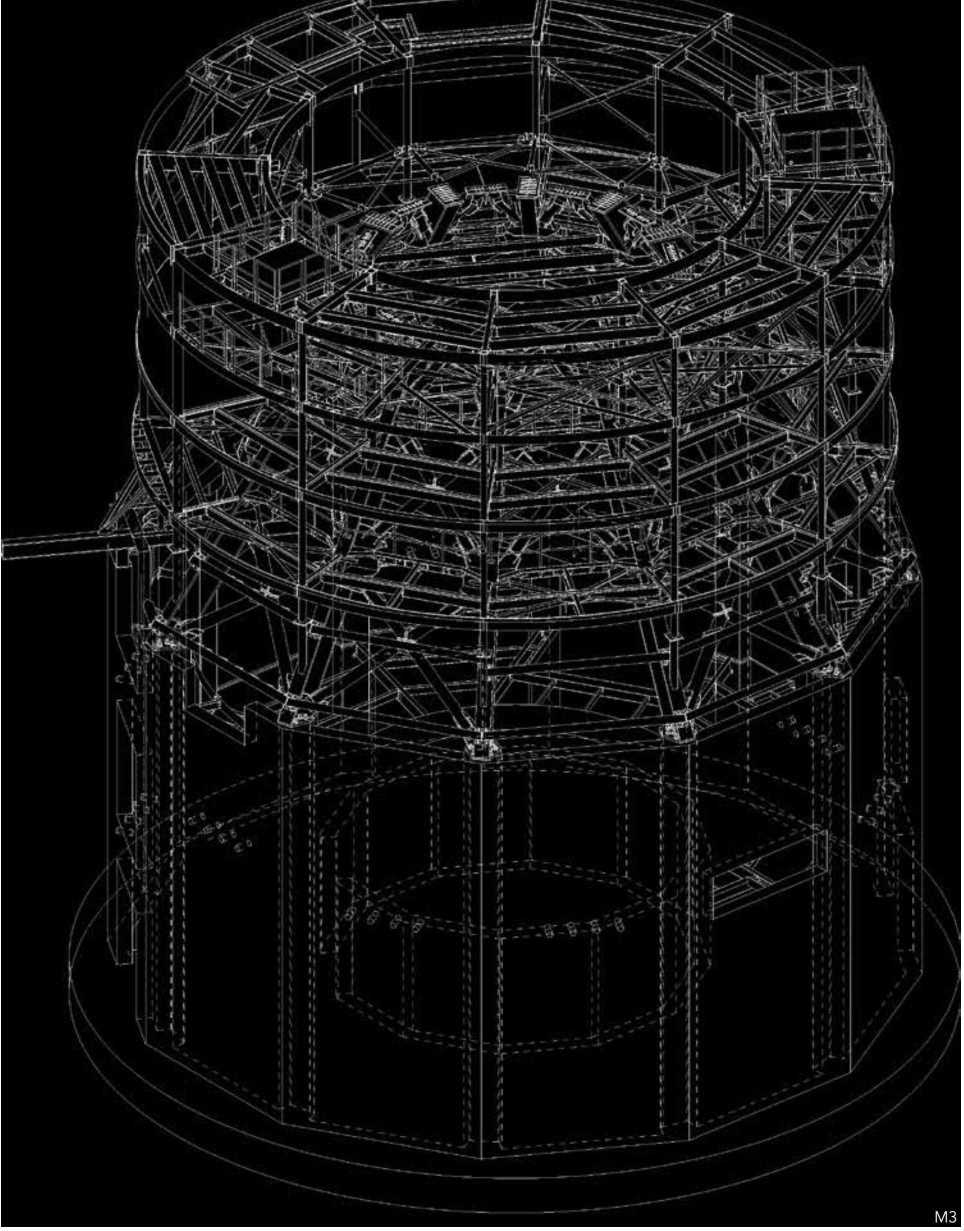
THE FUTURE OF the Daniel K. Inouye Solar Telescope (DKIST) is bright—really bright.

Situated at an elevation of 9,980 ft on the summit of the Haleakala National Park in Maui, Hawai'i, it is the world's largest optical solar telescope aimed at broadening solar physicists' understanding and interpretation of the sun and its complex interaction with the solar system. The telescope operation consists of an unobstructed 13-ft off-axis primary mirror to include state-of-the-art adaptive optics and instrumentation, which improve image resolution and minimize distortion. For years to come, DKIST will unravel many of the peculiarities and anonymities underlying the generation of cosmic magnetic fields and astrophysical plasma processes along with predictive modeling to forecast their effects on Earth.

A certain hierarchy is practiced in astronomical observatory design. In a general sense, the science mission of the observatory—telescope size, number of mirrors, mirror diameter, altitude axis and access to the telescope and its instrumentation—are of primary concern. The telescope pier structure that supports these elements is considered ancillary in nature and must be designed to fit within the remaining space allocation. In other words, form follows function—though obviously function wouldn't be possible without a strong form.

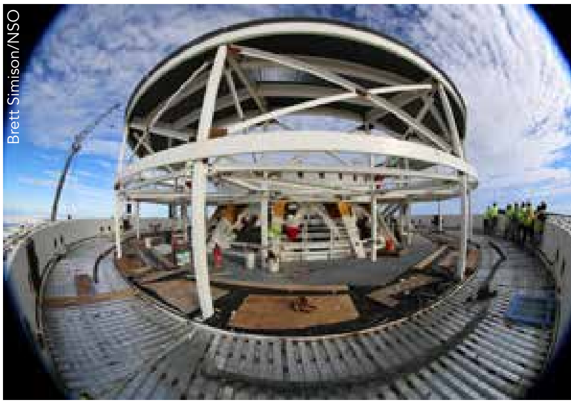
The telescope pier structure is directly below the telescope's azimuth track and provides independent support for the telescope. Thus, the geometry the pier assumes is largely predicated on the former and to its detriment cannot be the intuitive, squat structure with a low height-to-diameter ratio one would logically pursue.

From a historical standpoint, legacy telescope designs have been almost indiscriminately founded on massive cylindrical or polygonal concrete structures, as these are perceived to reduce vibration, thereby minimizing image distortion. At the onset, the DKIST pier was conceived as a cast-in-place lower dodecagon (12-sided polygon) with an upper truncated conical shape. This geometric arrangement was driven by the 29.5-ft diameter of the telescope base and the 52.5-ft diameter corotating Coudé laboratory inside the lower portion of the telescope pier. However, the telescope's lead mechanical engineer, the DKIST site construction manager and structural engineer M3 Engineering and Techonology Corporation concluded that building a tapered concrete upper pier section on a remote project site subject to strict mechanical tolerances would be cost-prohibitive and exceedingly complex. As an alternative, M3 suggested the possibility of a hybrid steel upper pier and a concrete lower pier, which gained closer consid-



M3

Brett Simison/NSO



Brett Simison/NSO

M3

eration and ultimately was selected for design and detailing. This hybrid steel-concrete solution is unique and completely new to the observatory community.

The framing configuration consists of inclined steel jumbo columns and square tube X-bracing, and approximately 375 tons of steel was used. At the top of the columns, a head ring was provided to join the azimuth track with the telescope pier. The head ring is a built-up, radially stiffened steel disc with manholes to facilitate bolted installation.

The upper steel pier structure was required to meet micron level operational deformations. As a result, the size and proportions of the column and bracing elements are seemingly larger and more robust than that of a traditional building. For example, W30×326 wide-flange columns with HSS10×10×⅝ braces were required to ameliorate pier deformations, whereas W14×48 columns with HSS4×4×¼ bracing would have sufficed under force based considerations. The single-story X-brace configuration was selected due to its superior stiffness compared to other bracing options. Of particular importance was detailing brace end-connections such that stiffness continuity was maintained through the brace-to-column. Though not a driving factor, the hybrid telescope pier was deemed lighter than the conventional concrete pier, with the added benefit of reduced seismic demands.

Access, ranging from personnel doors, a monorail crane to HVAC equipment and a removable floor at the utility level, provided additional challenges to designing within the allotted deformation budget. The proposed upper concrete section and the number of pier penetrations would have significantly reduced pier stiffness and performance. In the case of HVAC ductwork, open latticework bracing system with welded brace intersections facilitated routing a maze of ductwork and facilitated stiffness reduction.

The telescope pier columns are inclined at a 33.89° angle from vertical. To facilitate and expedite column erection, adjacent columns and infill bracing were assembled as steel bents by Parsons Steel Erectors (an AISC member and certified fabricator). Additionally, Parsons also developed rigging configurations for the bents, which were test lifted on the erection angle at the fabrication yard. This drastically reduced site assembly and alleviated many challenges associated with the pier erection.

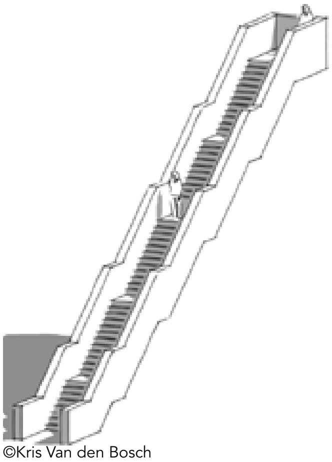
The DKIST project traversed new terrain with the successful implementation of a complex hybrid steel-concrete telescope pier, representing a departure from the familiar and expanding horizons for future telescope projects.

What's COOL in Steel

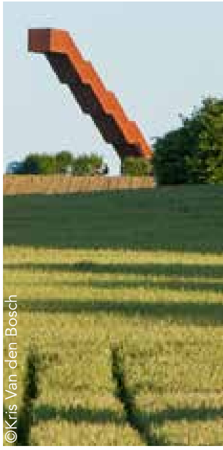
Cool Tower
Going Up


©Kris Van den Bosch


©Kris Van den Bosch


©Kris Van den Bosch


©Kris Van den

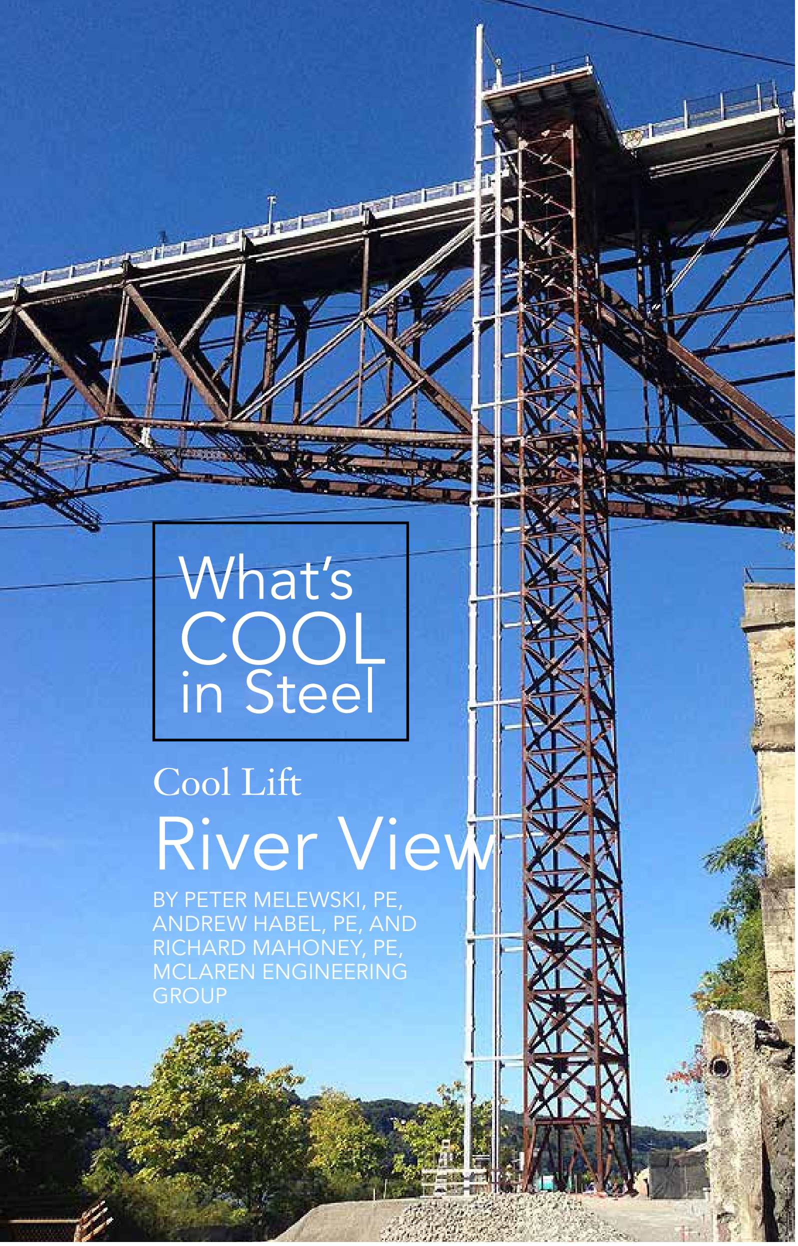

©Kris Van den Bosch

A SIMPLE WOODEN TOWER once overlooked the Kabouterbos "fairytale forest" in Tielt-Winge, Belgium.

Alas, the 4-m (13-ft) tower was irreparably damaged by vandals and had to be closed due to safety concerns. Local officials decided to replace the tower but knew they needed to do so with a sturdy and vandal-proof structure—but also one that was inspiring and seemingly magical (after all, it is the fairytale forest). The specification for the project dictated that the replacement must be made completely of metal and stand at least 10 m (33 ft) high.

Design firm Close to Bone came up with a structure that satisfied these requirements. Its creation, the Vlooybergtoren, is a staircase that cantilevers 37 ft into the air from the hill. Supported by a galvanized structural steel frame, it is clad with weathering steel whose reddish-orange hue pays homage to the region's ironstone.

Using just over 15 tons of steel, the staircase features two vibration dampers to resist the forces of eager climbers, and its left and right handrails act as structural beams to resist both gravity and visitors' weight. Held in place by structural bolts, it appears to float above the landscape. The staircase was fully prefabricated and was assembled on-site—and only took half a day to erect.



What's COOL in Steel

Cool Lift

River View

BY PETER MELEWSKI, PE, ANDREW HABEL, PE, AND RICHARD MAHONEY, PE, MCLAREN ENGINEERING GROUP

IN 2009, NEW YORK held a statewide celebration of the 400th anniversary of Henry Hudson's voyage to the new world and discovery of New Amsterdam.

There was one pivotal project that would serve as the state's legacy gift for this celebration: "The Walkway over the Hudson." The once-thriving Poughkeepsie-Highland Railroad bridge and freight connector had been left underused and abandoned since the 1970s. However, thanks to a group of visionary community members, the bridge was repurposed into a functional pedestrian walkway for the public to enjoy breathtaking views of the Hudson from 200 ft above the river, and nearly a half-million people visit the bridge every year.

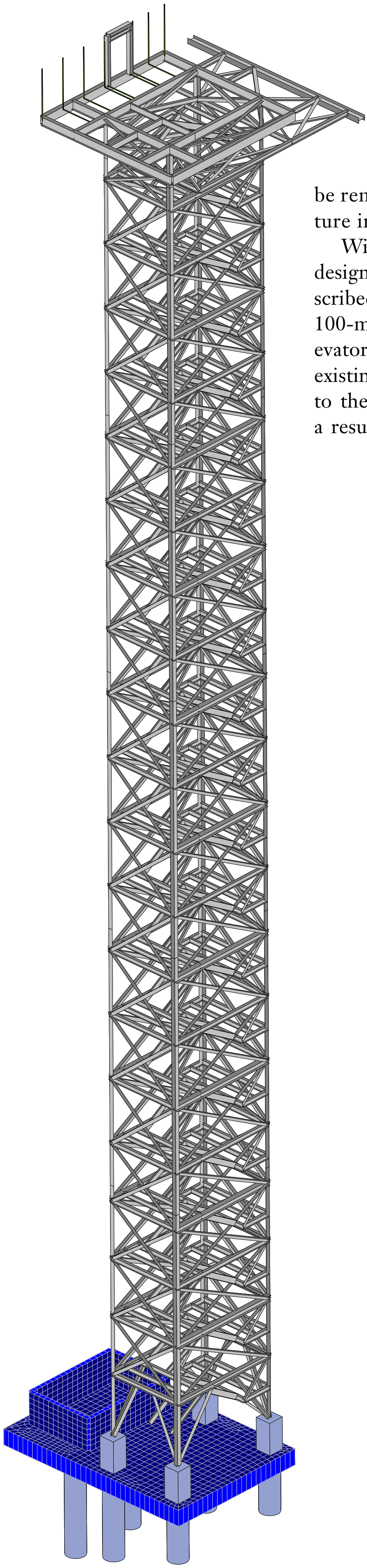
Since the inception of its design, many stakeholders wanted to create an elevator on the east shore of the Hudson River, which was approximately the midpoint of the bridge. The new site of the elevator was to be 0.75 miles from the walkway's west entrance and 0.5 miles from its east entrance.

Only $2.8 million was available for design and construction of the elevator project, so economy was critical. To reduce construction costs, McLaren designed an exterior elevator while preserving the historic industrial nature of the bridge. The elevator would be installed on the west side of the steel tower to provide the best views of the Hudson River.

The design team's collective experience was that a rack-and-pinion elevator, the same type of elevator found on construction sites, was the best type of exterior elevator for resisting the dirt, snow and rain that would inevitably find its way into the mechanics of the elevator. However, the problem with most rack-and-pinion elevators is that they are typically a rougher ride than what the general public is used to.

Once the elevator manufacturer (USA Hoist) was selected, design for the steel tower began. The cross-braced, steel-framed tower was to be 21 stories, with a minimized footprint of 12 in. by 18 in., and was constructed of of A588 weathering steel angles to match the look of the existing bridge and to save costs associated with painting (the steel was fabricated by AISC member and certified fabricator STS Steel, Inc.).

Special attention was given to detailing the steel to preclude ponding and to provide drainage holes where ponding was unavoidable, in order to prevent excessive corrosion. Although economy was at the forefront of design considerations, careful thought was given to future expansion. The steel tower was designed to accommodate future steel-framed stairs at the tower's interior and a second elevator to be installed at the east side of the tower. At the upper level, the center section of the deck was designed to



be removable to accommodate the future interior stairs.

Wind controlled the tower's lateral design, which factored in code-prescribed wind pressures resulting from 100-mph winds. Because the steel elevator tower was to be attached to the existing railroad bridge, it was subject to the sway of the existing bridge. As a result, the elevator tower design accommodates this induced deflection from the sway of the bridge.

The tower construction proceeded on schedule and within budget and was completed in approximately 17 months. Since its opening, the elevator has added a convenient way for the public to enjoy and experience one of the Hudson Valley's most popular attractions.

Ranquist Development Group

What's COOL in Steel

Cool Restart

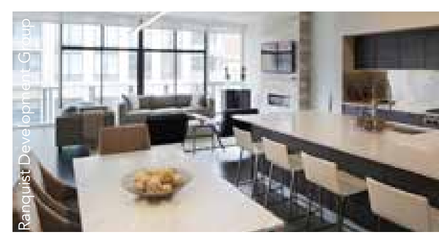
Filling In

BY BOB RANQUIST, RANQUIST DEVELOPMENT GROUP

Ranquist Development Group

Ranquist Development Group

Ranquist Development Group



Ranquist Development Group

THE GREAT RECESSION OF 2008 all but sucked the life out of U.S. real estate development, especially in the urban multi-family housing sector.

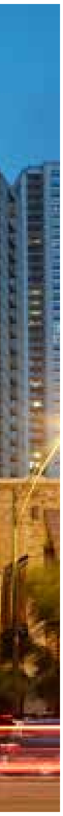
In cities around the country, numerous projects were stopped dead in their tracks, leaving vacant lots and, in a few cases, empty buildings standing as monuments to a stalled economy.

One such development project in Chicago left a derelict shell at 747 North Clark in the city's River North neighborhood since 2009. But as the financial climate improved, Chicago developers Bob Ranquist and Zev Solomon put together a team to revive a nondescript building start into an inspired infill multi-family residential building. Seattle-based Miller Hull Partnership out of Seattle led the design, Sullivan Goulette in Chicago served as the architect and SP Engineers was the structural engineer.

The design team wanted the building to acknowledge the great tradition of steel and glass architecture in Chicago, with the facade allowing expression of the building's internal structure—much as Mies van der Rohe did with his famous apartments along Lake Shore Drive. For that reason, steel channel and bent steel plate were used in a rain screen application to face party walls and floors. The steel facade continues up as a seventh-floor pergola, tying the facade elements together and extending them to a more graceful vertical proportion. Steel plate applied to the walls of the ground-floor parking garage further celebrates the material's beauty. A clear coat of Permalac protects the ground-floor plate while high-performance paint was used to protect the steel frame.

Each condominium is arranged on its own floor, with private in-unit elevator access. Clean lines and a palette of industrial materials, as well as exposed fasteners, give this project an authentic, urban feel in line with the industrial character of the surrounding neighborhood. The structural steel frame allowed for an expansive glass facade with windows that infill the steel elements on the street facade of the homes, allowing for a large amount of natural light. Custom finishes, including imported Italian cabinetry, complete the seamless interior and contrast nicely with the visually raw materials used on the exterior of the building. To that restrained paring is added a charred oak entry door, hot-rolled steel siding and wood ceilings. All units are between 2,000 sq. ft and 3,000 sq. ft and include private balconies and/or private terraces.

With the building stock in American cities aging quickly and energy efficiency becoming increasingly important, the opportunity and need to update existing in-fill buildings in established neighborhoods is necessary and becoming more financially viable as buildable land diminishes. And this former eyesore provides a solid link to Chicago's esteemed architectural history, rooted in steel and glass, making a positive contribution to the character of this popular urban neighborhood. ■



Ranquist Development Group

Ranquist Development Group

Ranquist Development Group

Diagram – Miller Hull Partnership