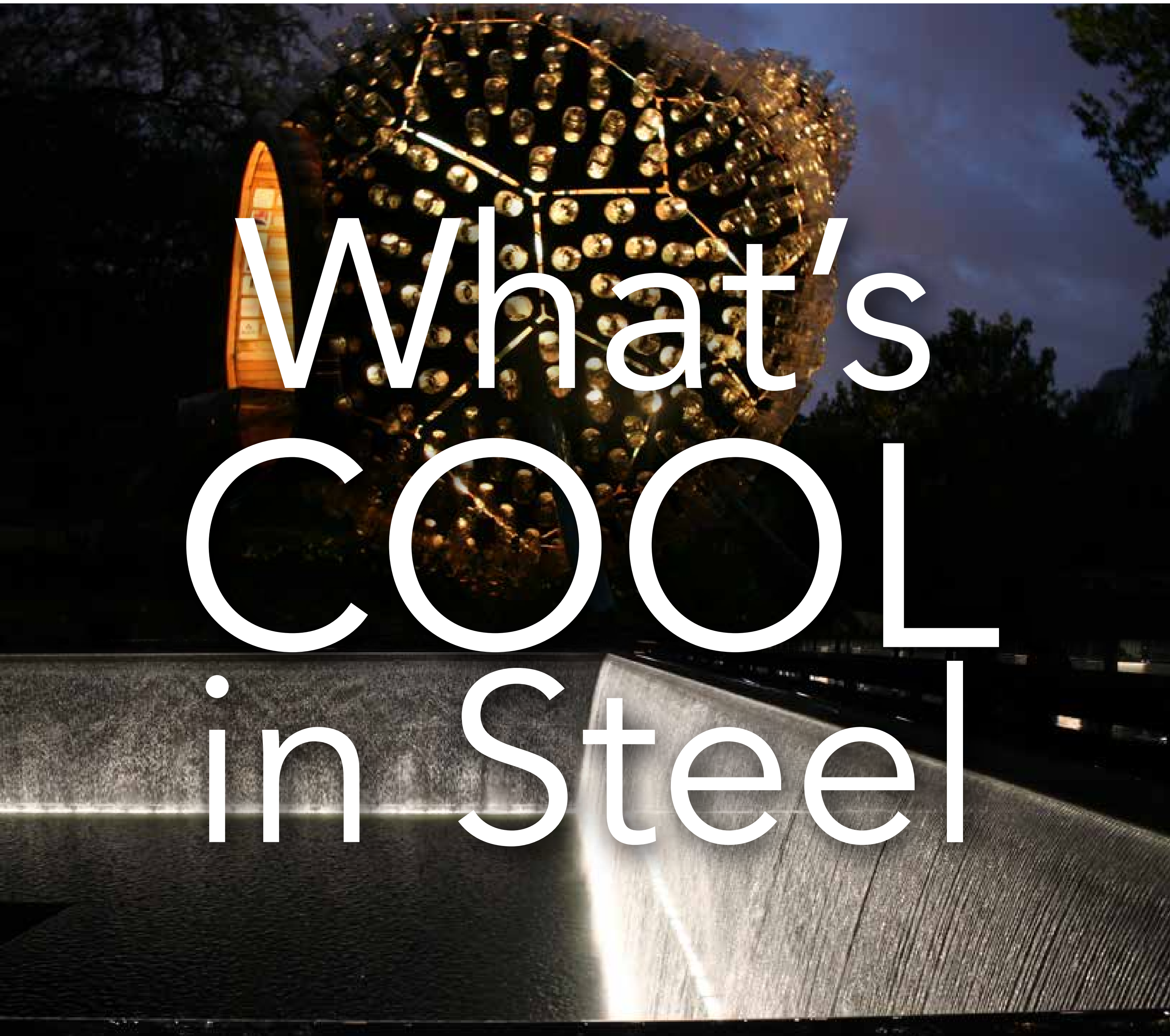
Each year *Modern Steel* presents a compendium of fun projects showcasing the cool use of steel. This year's Cool List features two former silos—one for missiles and one for grain—that have been transformed into high-end residences,

What's COOL in Steel



a bridge in the "trees" of downtown Houston, a birdhouse built for people and other unique steel creations. View even more photos of these projects at **modernsteel.com/cool2015**.

Cool Cube

Boxed In

BY AMANDA J. CLEMENTS, P.E., HGA ARCHITECTS AND ENGINEERS

THE NORTH DAKOTA HERITAGE CENTER expansion in Bismarck has created a new tourist destination for the State Historical Society of North Dakota.

The 97,000-sq.-ft addition, which opened last fall, was designed by HGA Architects and Engineers and nearly doubles the original Heritage Center, adding expanded galleries, learning labs, a 60-seat digital theater, conference space and a café.

Architecturally, the Heritage Center presents a dynamic community presence on the State Capitol campus. The limestone exterior complements the existing campus buildings while a glass-and-steel Northern Lights Entrance Atrium gives a nod to Native American architecture. As the building's centerpiece, the 45-ft-tall atrium is a striking example of architecture and structural engineering, merging to create a welcoming community space that serves as the heart of the Heritage Center. At night, the illuminated atrium is a glowing beacon to the community.

The atrium incorporates custom unitized triple-glazed curtain wall with custom-welded T-shaped mullions made from A36 steel plate. The mullion connections, in which single plates at the top of the horizontal mullions were used with countersunk bolts for ease of erection, are discreet (and cost-effective). The glazing system's thermal performance was crucial for achieving the large glass box design of the atrium in the harsh winter climate of North Dakota, and the system's significantly improved condensation factor reduced the need for heat on the glass. The rainwater leader for the atrium roof and conduit for the lobby lighting were hidden in a corner mullion, and a hole in the mullion support beam allowed the pipe and conduit to continue unseen into the low lobby roof framing hidden behind the finishes.

Twenty 8-in. round HSS columns support the atrium roof at the perimeter. Compression struts framing from a central compression ring provide bracing for the pipe columns and T-mullions, and the clevis system used for the struts connection is fully field-adjustable to aid in erection. The project team modeled the lobby's entire structural system in Revit as a parametric family so that the system geometries could be adjusted during design development. Synergy Steel Structures, Inc., of Lansing, Ill. (AISC Member/Certified) was the project's fabricator.

The struts and compression ring system act as bracing for the columns and mullions under gravity load and also serve as the lateral system of the atrium box. Wind loads are transferred from the exterior mullions through the struts and compression ring to four connection points back to the main building at the low lobby roof and through to the mechanical mezzanine level above the adjacent lobby. The composite slab diaphragm distributes the lateral point loads to the braced frames within the main building structure.

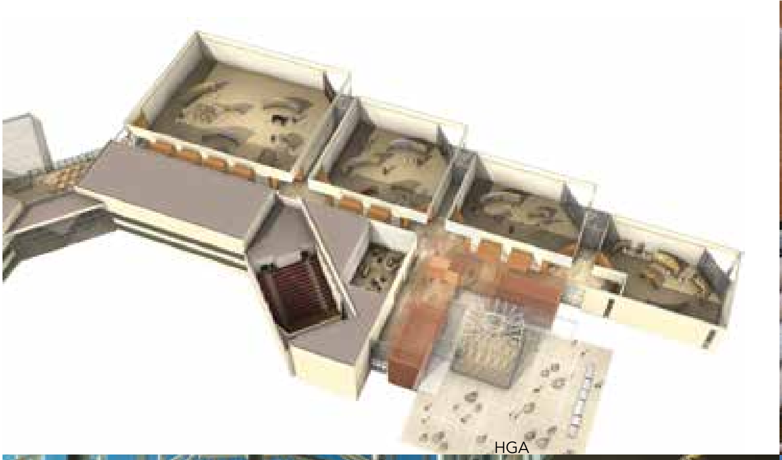
Surrounding the atrium is a copper, L-shaped element that includes cantilevered canopies at each end and cantilevers for the lobby roof along the atrium sides. The end cantilevers are 16 ft while the low lobby roof cantilevers extend 13 ft, 6 in. from the building's column line. The canopy and roof framing design was complicated by the glass atrium's steel mullions, which bear on the cantilever tips of the low lobby roof framing. Because the shallow structural depth required heavy beams for the long cantilevers, anticipated dead load tip deflections were specified and the end plate moment connections to the columns were fabricated with the beams skewed at the plate. Other canopy and low lobby roof detailing included setting the roof deck down into the beams to minimize depth and multiple variations on moment connections that were needed to deal with the double cantilevers, various column conditions and in-framing beams at different elevations.

Loren Ahles

Brian Austin

What's COOL in Steel


Loren Ahles


HGA


Brian Austin


Loren Ahles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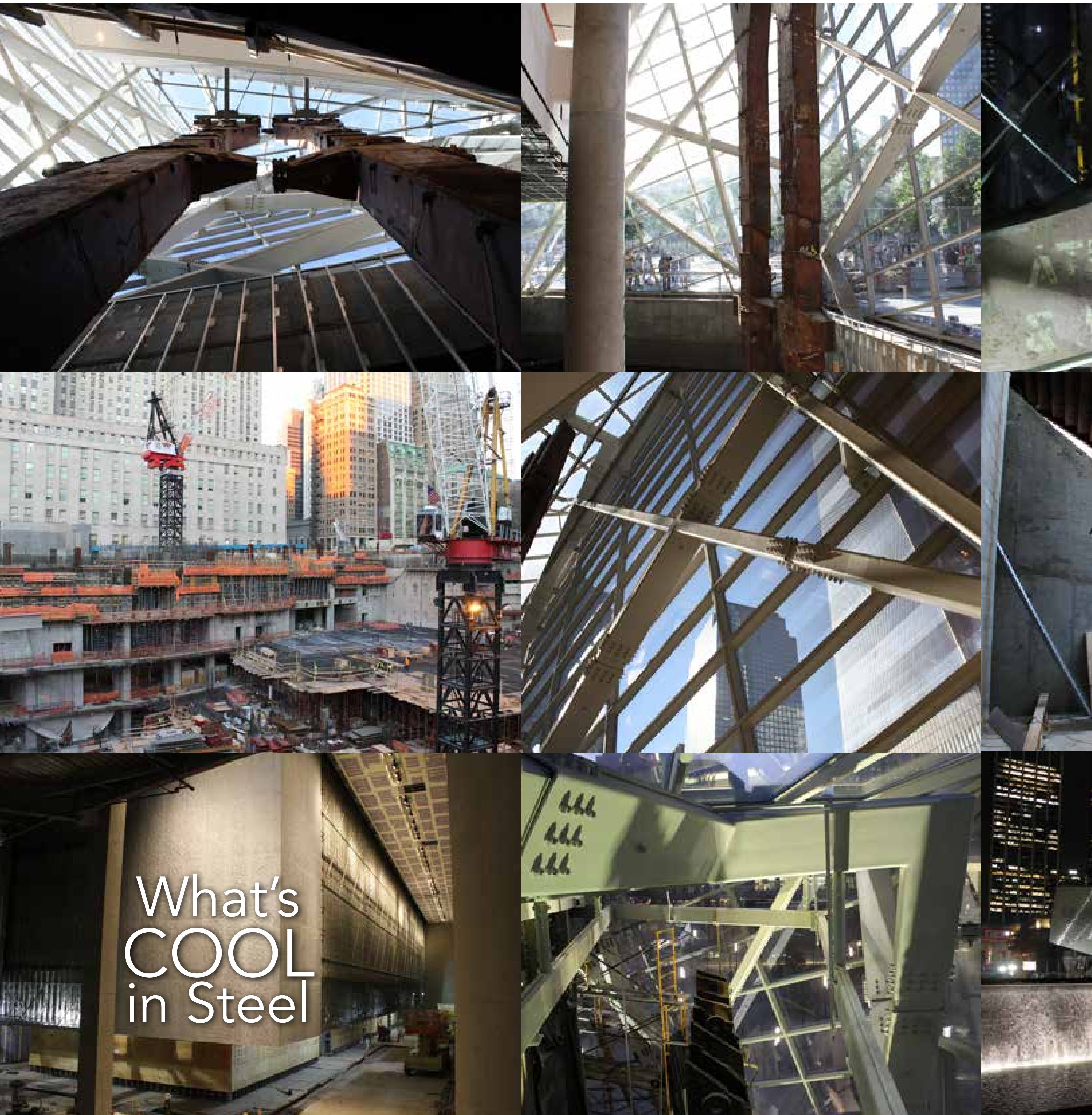
Cool Tribute

Monument of Perseverance

BY ERLEEN HATFIELD, P.E., BUROHAPPOLD ENGINEERING



AMIDST THE NEW SKYSCRAPERS of the World Trade Center site is an edifice whose stature is much smaller, but whose impact is not.

Located between the twin reflecting pools in Memorial Plaza, the National September 11th Memorial Museum Pavilion is an organic metal-clad form with a glass-enclosed atrium. Designed by Snøhetta, the 47,600-sq.-ft building serves as an entrance to the subterranean Memorial Museum. Using approximately 1,100 tons of structural steel, the Pavilion structure slopes in height from 57 ft to 72 ft and includes an auditorium, multi-purpose space and a private suite for victims' family members.

At first glance, the most notable feature of the Pavilion is the atrium surrounding two tridents salvaged from the north face of the original World Trade Center north tower. The seven-story, three-pronged tridents are housed in an intricate web of steel and provide an anchor for the building and the entire site. The tridents were removed from the site of the original towers during the rescue and clean-up effort in 2001, stored for a decade then erected inside the Pavilion as the structure continued to be built around them.

When it comes to the atrium itself, the façade appears as a random pattern of lines. In order to validate the proposed design scheme for the blast-resistant atrium, BuroHappold Engineering completed a detailed analysis of the feasibility of the angled, web-like design of the primary structure and developed alternate schemes based on an orthogonal grid layout. The analysis resulted in the development of customized nodes in order to make the construction of the atrium both feasible and cost-efficient. The customized nodes were shop welded while the architecturally appealing, bolted splices were located at points throughout the façade tube members to allow for simplified field erection. Recognizing the complex geometry, fabricator and erector W&W|AFCO (AISC Member/Certified) performed a complete trial assembly of the atrium structure in the shop to assure accurate field fit-up and to assess the appearance of the exposed steel that would be viewed by millions of visitors.

While the steel atrium is a great structural achievement, the true feat of engineering will be unobserved by most visitors. Constructed on one of the most complex sites in the city, the Pavilion is structurally unique in that it is not directly supported on the ground. The majority of the Pavilion is constructed over Santiago Calatrava's PATH Terminal Great Hall, while the other portion is constructed over the subterranean Memorial Museum. Given that the Pavilion had no true foundation on soil and the building's gravity loads needed to be distributed across the two structures, an innovative structural design was required that could meet both the building code and the stringent security requirements for the site.

Achieving this was no small feat because the Pavilion has 12 columns that do not align with the below-grade structures due to two Port Authority girders that do not span the length of the Pavilion's site. These Pavilion columns had to be supported on transfer structures below grade. Additionally, all lateral forces on the building had to be transferred through plaza-level grade beams to the below-grade museum and PATH station lateral system. The north edge of the Pavilion appears to float due to a concrete base resting on three girders that connect to the Port Authority girders below grade, and a full-story-tall steel truss extends from the pavilion's core to effectively cantilever the building over the PATH station hall. A custom-designed system of 3-in. joints between the building and the Plaza was also employed, allowing vertical movement of the building, which is not connected to the Plaza.

Though striking from the outside, even more striking is the experience as one travels down the custom-designed grand stair within the atrium. The complex HSS 30-ft-tall freestanding stair has limited structural support, appearing to float, and brings visitors within close proximity to the tridents in the large, naturally lit atrium. Visitors will descend nearly 70 ft below street level via a staircase, escalators and elevators to reach the Memorial Museum, most of them not realizing the monumental design and construction efforts that went into creating the Pavilion above these sacred spaces.

Cool Silo

Farm-Fresh Housing

THE SILO HOUSE is exactly that.

Nestled in the Garfield Historic District of downtown Phoenix, Ariz., this contemporary rehabilitation of a dismantled 1955 grain silo challenges conventions of what a house is.

Design architect Christoph Kaiser of Christoph Kaiser, LLC, developed the design concept and personally funded the project. When he discovered a Kansas farmer's dismantled silo for sale on the internet, the dream of creating an ultra-compact yet comfortable living environment with untapped resources was born. Assembling a found "kit of parts" small enough to be transported in the back of a pickup truck that would result in a comfortable, modern and unique home was a very appealing design challenge from a sustainability and economic point of view.

The main objective of the Silo House was to capture the feel and function of the typical home in a radically different, radically smaller configuration. Working with only a 190 sq.-ft, circular footprint, the program is a comfortable, one- to two-

What's COOL in Steel

Photos: Mark Lipczynski Photography

person home that targets market demands for affordable, modern living space. The design itself is conceived as the marriage of two different but complementary parts: exterior shell and interior object. The silo's exterior, preserved in white, pays homage to the rural and agricultural spirit of the great American landscapes, and also serves to reflect the intense desert sun. An operable oculus located at the top of the silo allows for passive ventilation of the interior space.

With regard to framing, there is both exposed steel (chemically blackened and clear-coated) throughout the interior and structural steel at each door and window opening. The kitchen is framed with 2-in. HSS. Horizontal members are radiused to match the silo, clad on top with ½-in.-thick Corian countertops and ½-in.-thick water jet-cut steel plate. The columns at each door/window opening are 4-in.-square HSS.

The spiral stair is a 3.5-in.-diameter HSS post with water jet-cut steel treads, topped with walnut planks. The large radiused rolling door on the back side of the silo is a custom fabricated sliding door that rides on internal 6-in, V-groove polyurethane wheels and is topped with a custom radiused square tube overhead beam. The light fixture above the dining table is also a custom fabricated blackened steel piece that suspends a translucent piece of glass over the dining table. All air registers are also custom steel and have speakers, WiFi antennae and a digital projector integrated into the center register. The sofa, table and bed frames, and shoe storage wall are all steel pieces, also designed by Kaiser.

Cool Flight

Stop and Stair

BY ANTHONY P. HARASIMOWICZ, P.E., KPFF CONSULTING ENGINEERS

Photos: Anthony Harasimowicz

INTEROFFICE STAIRS come in many forms, shapes and sizes, from the economic and utilitarian to the ultimate in open, floating designs that push engineering limits.

As part of a tenant improvement project for their new office in the heart of downtown Seattle, Hargis Engineers, Inc., a mechanical engineering firm, required a functional and open communicating stair between the two floors of their new space. The stair allows inter-office access between the sixth and seventh floors of the building and is situated adjacent to staff break areas. A setback in the building floor plan at the sixth floor creates a natural roof deck, which is accessed through doors from the sixth floor-break area. Floor-to-ceiling windows afford spectacular views of Elliott Bay from both break areas and the stair between.

Creating large new floor openings can be challenging in existing buildings but is typically easier to accomplish in steel-framed

structures. The constraints for this new stair opening were made straightforward by carefully locating the stair to fit between the existing floor framing members. Coordination of the stair with the main building framing was simplified by the availability of existing structural drawings as KPFF had designed the original 55-story tower. Care was taken to avoid the existing moment frame connections between built-up girders and large columns given the new stair was directly next to one such joint.

The kinked stringers selected for design were MC8×18.7 members. The shallow profile was preferred architecturally and the ½-in.-thick by 3-in.-wide flanges helped with overall stiffness as well as the attachment of thick steel blocks and folded plates supporting the stair treads. The two stair flights share a single intermediate landing level between main building floors. The landing is supported by a matching MC8×18.7 header with a single angle hanger utilizing simple bolted connections at each end.

An important visual requirement for the stair was to maintain the original mill finish of the steel. The stringers, tread support members, railing support outriggers and the ¾-in.-thick railing bars were Penetrol clear-coated to preserve the mill steel's raw color and finish. During fabrication, reworked areas including the fully welded joints of the kinked stringers were ground smooth and then re-torched by hand (known as "bluing") to blend the finish of the complete member. The railing support outriggers originally shown as small HSS members were not available from local steel suppliers. Instead, hot-rolled bar stock was selected, which matched the required size and finish. Careful dimensional coordination was also required for transporting the finished stringers to the job site. Final shop drawings noted the overall assembled member lengths to confirm the pieces could be fit into the building's elevators. Field welding of the stringers was not desirable due to finishing concerns.

The raw steel look continues along a side wall insert and bench area of the stair with finish-matched 12-gauge plate. The wall plate was laser cut around the MC8×18.7 profile where the intermediate landing header passed through the wall and connected to the existing column. The final accent for the stair utilized 2⅝-in.-thick reclaimed wood members for the stair treads, landing and bench area at the base of the stair. (The lumber was provided by Rhine Demolition as part of the 2014 IDEAS^2 national award winning U.S. Army Corps of Engineers Federal Center South Building 1202 redevelopment project in Seattle.) The large Douglas fir members from the original warehouse building were ripped and finished to create the planks for the stair. Finish-matched and inset steel nosing angles protect the wood tread edges.

Form certainly meets function as the entire stair assembly fits in perfectly with the new, yet raw look of the office space. Clean and neat cubicles are set against hallways with fireproofed beams and decking above left exposed as well as shiny duct runs to show off the tenant's area of expertise. The stair got an immediate workout as part of an open house, where employees and clients alike were all invited to see and enjoy the newly finished office.

Cool Pod

Small Space, Big Imagination

BY ANA CALHOUN AND PATRICK WINN, OVERLAND PARTNERS ARCHITECTS


Scott Adams


Scott Adams


Courtesy of Overland Partners


Fernando Ortega


Scott Adams

THE GOURD IS part art installation, part human-sized birdhouse. Built for the San Antonio Botanical Gardens, it seeks to uphold the gardens' mission to inspire people to connect with the plant world and understand the importance of plants in our lives.

Rather than pursuing a form that resembles a small human house—as is typically seen in most birdhouses (human-scale or otherwise)—the design team chose a form inspired by the bottle gourd, first used in its hollowed-out form by Native Americans to attract Purple Martins as a nesting spot. The organic form, designed by Overland Partners Architects and Datum Engineers, inspires creativity and imagination—particularly in its youngest of users who have affectionately nicknamed the structure the "pineapple house" and "spaceship"—while pushing the limits of digital design and fabrication.

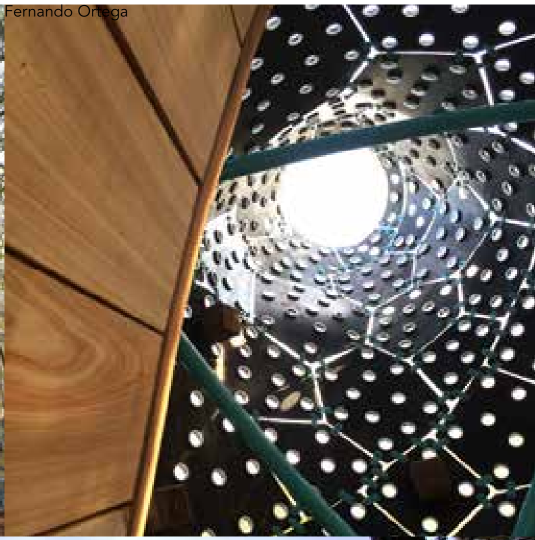
Assembled by a team of more than 40 Overland staff members, the Gourd is built out of 70 plates of 12-gauge weathering steel wrapped around a robin's egg blue internal octahedral structure and perforated with over 1,000 Ball Mason jars. The jars illuminate the interior space while providing a visible connection to the outside world. Each steel plate, unique in shape and size, was fabricated using CNC laser cutting technology and emulates the pattern of a dragonfly wing—a pattern selected because of its characteristics as a Voronoi tessellation, an irregular tessellation that allows the steel to bend to create an asymmetrical, organic form.

This steel structure is comprised of three main components: x-strong steel pipe legs, a rolled pipe octahedral frame and the steel skin. Fastening at only three points around the base of the Gourd, the legs provide the structural connection to the ground, with three concrete spread footings serving as the foundation for the legs. The footings connect via underground tension cables and turnbuckles to prevent each from splaying in the direction of the angled leg.

The steel octahedral structure is fabricated from rolled arcs

Scott Adams

Courtesy of Overland Partners



Fernando Ortega

Patrick Winn

What's COOL in Steel

of std. pipe and is fastened at their intersections with custom laser-cut and bent steel hubs. The hub detail is a pivotal component of the design as it mediates the connection between the rolled pipe frame, the three x-strong pipe legs, the tube steel floor and the steel skin. Each hub is designed around an X-shaped disk with four rounded arms, laser cut out of ½-in.plate steel and then bent inward 15° with a CNC brake. On the upper end of the Gourd, these disks have a 3-in. extension pipe that connects a round bolt plate for fastening the steel skin. At the lower three connection hubs, the extension pipe is fastened on both sides of the disk and is gusseted with a ½-in. plate for additional transfer of lateral loads to the legs. The extension on the exterior of the octahedron connects the frame to the legs, sandwiching the skin plates between two round bolt plates. On the interior of the octahedron, the extension pipe connects to a 1½-in. threaded stud that provides a bolted connection to the three bent steel J-plates that float the floor off of the structure.

Once fully assembled, which required each faceted plate to be bent by hand and then secured, the steel skin becomes a tensile balloon that can be self-supporting. As each plate flexes inward, the skin self-inflates while also providing the tensile support to lift the neck of the bottle gourd into its cantilevered position. Combining the structural support of the skin with that of the rolled pipe octahedral frame, the Gourd can delicately rest on a slope while supporting live loads from occupants in addition to increased dead loads from the integrated glass jars.

Fabricated and assembled in house, the project provided young designers a firsthand education in material characteristics and craftsmanship, as well as experience working as part of a production team. The project serves as an exemplar model of high-end digital fabrication and finely honed craft, bringing an experientially unexpected space to life for the local community.

Cool Bridge

Downtown Tree House

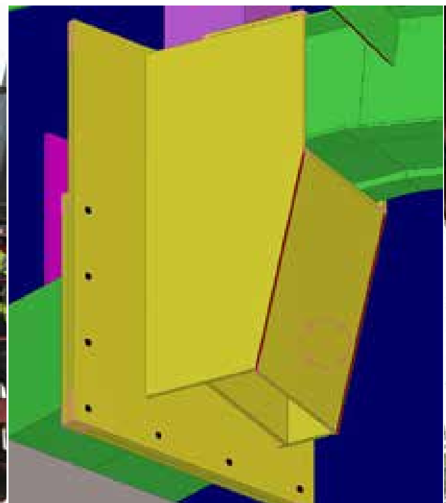
BY BRIAN SLANSKY, CRM STRUCTURAL SERVICES, INC.

TREE HOUSES EVOKE THE WHIMSY and imagination of childhood.

And sometimes real estate companies.

One such company, MetroNational, opted for a grown-up version of a tree house-inspired span to connect the existing Nexen office building to its new Treehouse Building in downtown Houston. Designed by architect Studio RED Architects and engineer Cardno Haynes Whaley, the bridge spans 38 ft and hangs approximately 45 ft above the ground, is 5 ft, 6 in. wide and cambers downward 1 ft, 4 in. with stainless steel cable rail and a roof to match the curve of the footbridge. Steel supports were added to the existing Nexen office tower, along with access to the bridge, but the new building was still under construction while the bridge was being built. As such, a landing for the bridge was added along with a small access stair placed on the rooftop garden of the new building.

Detailed by AISC Member CRM Structural Services, the footbridge is one rolled W14×68 that was sandwiched with a rolled C15×33.9 channel on each side. WT6×20 stub outs are at 4 ft, 8 in. o.c. and attach to the channels, and rolled steel angles then sit on the WTs on the outside edge of the footbridge framing. In addition, 1-in. grating was placed on top of the steel framing support, and springs were placed on the steel edge angles and Machiche wood planks were place on top



Photos: Brian Slansky, CRM Structural Services, Inc.

of the springs. In tandem with the downward camber of the bridge, the springs give occupants the feel of walking across a real tree house bridge.

In an elevation view, the footbridge looked simple but it was difficult to see what was taking place since everything was on a radius. And in many instances there were angles, WTs and stiffeners all in one location on each side of the main support—i.e., most of the parts were in the same line of sight. As such, CRM furnished single-part details for each item and multiple 3D views during fabrication so everyone could see what was happening. Furnishing the single parts reduced the amount of information needed on the main detail sheet.

The handrail tries to stay true to a typical tree house swinging bridge design as well. The rails are made of flat bar posts, flat bar top rail and stainless steel cable, and the grab rail is made of "twisted" 1½-in. square bar, which gives the appearance of being a rope handle. The roof is made of up of an HSS frame that is rolled to match the curve of the footbridge and the HSS supports are offset since the bridge is rotated approximately 20° off the face of the building.

The bridge lift was scheduled to take place on an early Saturday morning because this is normally a very busy area during the week. Luckily, there were no issues and the lift took less than an hour.

Cool Bunker

Surviving in Style

BY GEOFF WEISENBERGER AND DAVID T. MENZEL, P.E., MAI DESIGN BUILD

YOU MIGHT NOT associate farmland three hours northwest of Kansas City with phrases like "prime real estate," "luxury condos" or "Location, location, location!"

But in north-central Kansas near the town of Concordia is a 15-story building housing seven 1,800-sq.-ft condos—$3 million apiece—a movie theater, a swimming pool, a gym and an indoor dog park. And believe it or not, location is what drove the project.

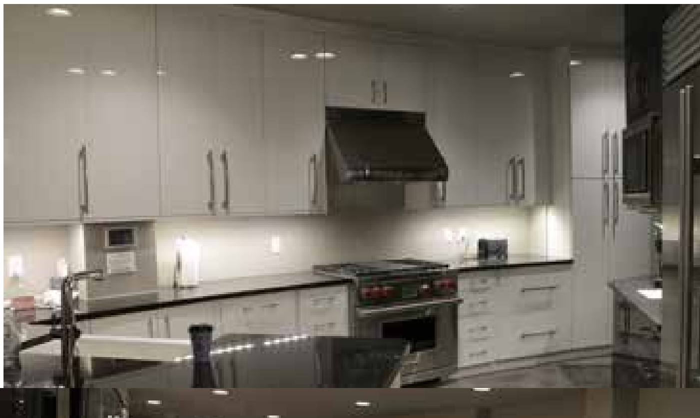
The brainchild of Larry Hall, the project (whose architect, structural/civil engineer was MAI Design Build) is built with survival in mind—and also style. The building is a self-sufficient system that is intended to house a handful of well-to-do residents in the event of a catastrophe, whether it would occur in the form of a global outbreak of a deadly disease, solar flares taking out the power grid, nuclear war or the breakdown of civilization as we know it. It contains its own pharmacy, closed-loop indoor aquaponics farm featuring a hydroponic vegetable garden and Tilapia fish tanks, security personnel, power generation (via solar, wind and batteries), a copy of a subset of the Internet, high-end fixtures and a filtration system that can provide air that's 10,000 times cleaner than what we breathe on a regular basis. The idea is that the residents, who can travel to their home away from home, have enough supplies, air and food to survive in the building indefinitely. Most bunkers are designed for a specific duration that they can be "off-grid." Not this facility. According to Hall, all life-critical systems had to be redundant.

Despite all of its amenities, the building's face is relatively modest. That's because almost the entire project is housed in an abandoned underground missile silo. The silo is 176 ft deep and 52 ft in diameter and not only provides the resilience and protection that such a project demands, but also a ready-made foundation and lateral system for the building's steel frame.

The building, which is 205 ft tall from the floor of the bottom level to the top of the domed roof, was built using a design-assist delivery model. It contains 13 stories below grade and the two-story top level, which is partially above and partially below grade, and uses 517 tons of structural steel in all.

The frame itself was fairly standard for a round, multi-story building. The lower, mid- and upper columns are a mix of W10×45, W10×60 and W10×88. The beams are mostly W16×26, W16×31, W16×40, W14×22, W12×120, W10×12 and W8×10. Rolled L6×6×$\frac{3}{8}$ were used around the shaft walls, while the stairs are MC12×10.6 stringers with HSS1½×1½×$\frac{3}{16}$ mesh guardrails and 1¼-in. std. pipe grab rails. In all, the frame uses 192 anchor rods, 77 column sections, 726 beams, 28 stair frames and 29 rail sections.

The steel framing also includes a ring beam at the bottom,



and pilings were also built to support the new structure. There is a 2-in. gap between the framing system and the silo walls, and the two entities are attached via anchor bolts; the framing system is also attached to the silo's original cap and the bottom ring beam. The silo shaft walls are at a 26-ft radius and the columns are set at a 25-ft, 3-in. radius.

Fabricator Midland Steel's (AISC Member/Certified) detailer worked directly with the engineer to make the framing the simplest as possible. For example, the rolled edge angle was originally a bent plate that had to be built up in pieces (it was changed to a rolled angle with outrigger angles).

Given that the project was far removed from any towns or other buildings, the construction team didn't have to deal with issues typical of urban building. The real challenge was erecting a frame in a 176-ft-deep hole, roughly 40% of which was covered with a 9-ft-thick concrete slab that capped the silo. Material obviously could not be flown in through the sides as in a typical building and instead had to be carefully brought in through the silo door area, which made the process much like building a ship in a (very dark) bottle. Hand signals weren't an option and the team had to rely solely on radio communication. Special rigging was used to bring the steel in, cables were flagged for depth and lifts were lowered onto the decking to help with erection. Given the 2 in. of space between the steel frame and the 1960s-era walls, the latter provided a backup system in terms of stability (though this never became an issue). As Ellen Jordan of Midland Steel put it, "At least we didn't have to worry about it falling over."

The project was constructed from the bottom up. A crane and offset pulley riggings used to lower the steel one piece at a time. The entire structure was pieced together and then the concrete floors were placed. In addition, there were many legacy fittings for water, sewer and the rocket fuel lines that were all built into the old silo walls that needed to be plugged. Hydraulic cement was injected into the pipes and compressed to permanently seal them. The silo walls were then pressure-cleaned from the top to the bottom, then a special closed-cell foam was sprayed to the entire surface of the silo walls. This step was critical as it provided both a vapor barrier and thermal break from the walls, which are a near-constant 52 °F. When it came to lighting the cave-like workspace, the team started with rough service 100-watt light bulbs on 100 ft strings. However, this was only slightly better than using candles, so the bulbs were upgraded to 6,500K daylight CFL bulbs.

Hall has taken his "lessons learned" from the first silo, which is now sold out, and has started work on a second facility in a nearby silo that will be nearly three times the size of the first project; it is scheduled to open in August 2017.

Cool Exposure

Heavy Metal House

BY KATHERINE HODGE,
HODGE STRUCTURAL ENGINEERS

RISING FROM THE GROUND as an angled mass of stone and steel, the Lake Barkley House makes its statement on the shores of its namesake in Western Kentucky.

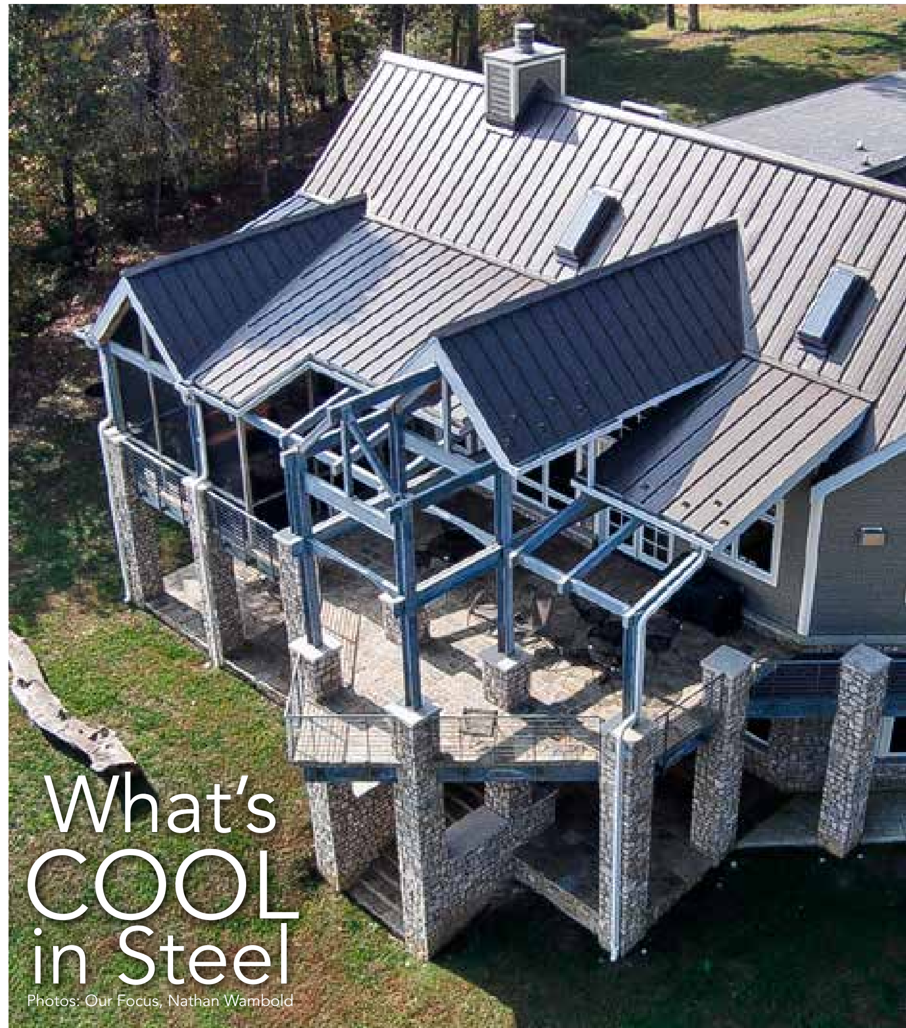
Designed by architect Design Works and engineer Hodge Structural Engineers, the two-story, 5,000-sq.-ft home manipulates natural light with vaulted ceilings and spacious rooms that provide absolutely beautiful views of the lake and forest through large windows.

Design Works originally envisioned using exposed heavy timber, but the owner desired exposed steel framing as an architectural element. The homebuilder had never put up a steel frame anything like what went into this project, so the design team developed drawings that specifically focused on the interface between steel and timber. This helped the builder's team clearly understand the designers' intent and made them more comfortable working with steel.

Tall exposed steel columns emulate the leafy, giant trees seen in the surrounding area. In a fashion that is a reference to the local deciduous forest, steel beams split off to form metal branches with leaves of wooden planks and a standing seam metal roof. The steel, all of which is galvanized, pairs perfectly with a stormy sky and the resulting hue of a leaden lake. The stones of the columns are an array of bronze, pale gray, and rich river browns, which match the lake stones that cover the shores below.

The front of the building appears to be a bow of a boat, not the façade of a house. The deck, with steel support, concrete and stone, comes to form a gazing point, which is safeguarded by powder-coated steel railings that evoke those of the *Titanic*. The entire structure is raw but refined; the steel beams are un-clad, the stone pilasters that support wide flange columns are unpolished and rough and the railing stanchions are bare and exposed. The steel is not just present on the outside of the building, but is expressed inside as well; the steel branches continue through the walls and cut through the kitchen and family rooms.

The Lake Barkley House may be an eclectic mix, but it works. The house connects with its surroundings by mimicking trees, shoreline and lake with the use of stone-covered columns, reflective windows and exposed steel framing.



Photos: Our Focus, Nathan Wambold






Cool Cladding

Seasonal Steel

IN THE WORLD OF CONSTRUCTION, it is rare for the architect, developer, contractor and client all to be the same person.

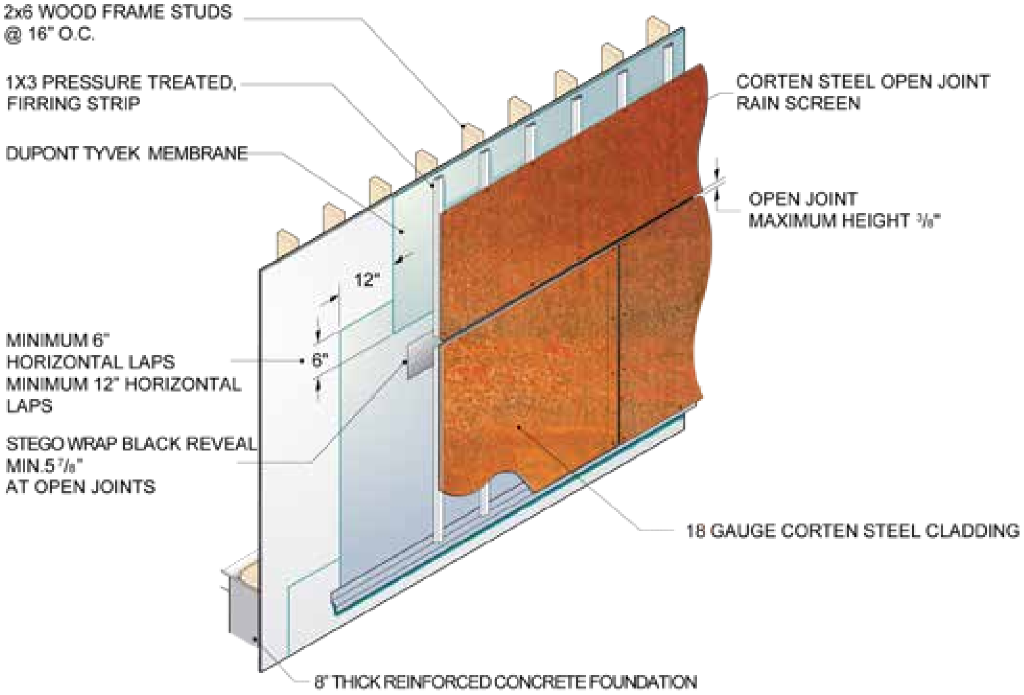
But that is indeed the case with a house in suburban Pittsburgh known as Bending Tree. Sean Hohman, a locally raised architect (who descended from three generations of carpenters and contractors), set out to build a single-family home that echoed the city's industrial roots. The result is a house made up of interlocking boxes intersected by roof planes that bring in nature while simultaneously paying homage to the region's steelmaking history.

Situated on 27 acres roughly 18 miles from downtown Pittsburgh in Fawn Township, the house features an unusual cladding system for the region: an open-joint rain screen using a combination of A588 weathering steel and fiber cement board cladding. Nearly three tons of weathering steel were used in all. The house also employs a structural steel framing system.

The cladding was installed as 18-gauge A588 plates attached to pressure-treated 1-ft by 3-in. pine firing strips with Grade 308 stainless #5 hex head rubber gasket self-tapping fasteners. The treated pine strips are attached at 2 ft O.C. over a waterproof membrane covering 7⁄16-in. OSB sheathing attached to 2-in. by 6-in. pine stud framing. The cladding encloses the office at the entry of the home. Rain water is conducted by custom-designed as 12-in.-wide open C channels that allow for the scuppers at the parapets to deflect the water back toward the channels as the energy of the water increases; this allows for the waterfall to flow down the surface of the open downspouts. Staining from the steel, whose patina changes over time, is kept in this controlled channel so as not to alter the appearance of other materials.

When first installed, weathering steel has the raw bluish color from the mill process. But with the large amounts of rain and humidity in Pittsburgh, within a few weeks to a couple of months it changes into oranges and browns, which blend in with the surrounding foliage in the fall. In addition, the weathering steel is continued from the exterior to the interior separated only by glass in the master bathroom shower; the 11-ft-tall main control wall in the shower features the 18-gauge cladding as well.

Photos: Richard Marsh



What's COOL in Steel