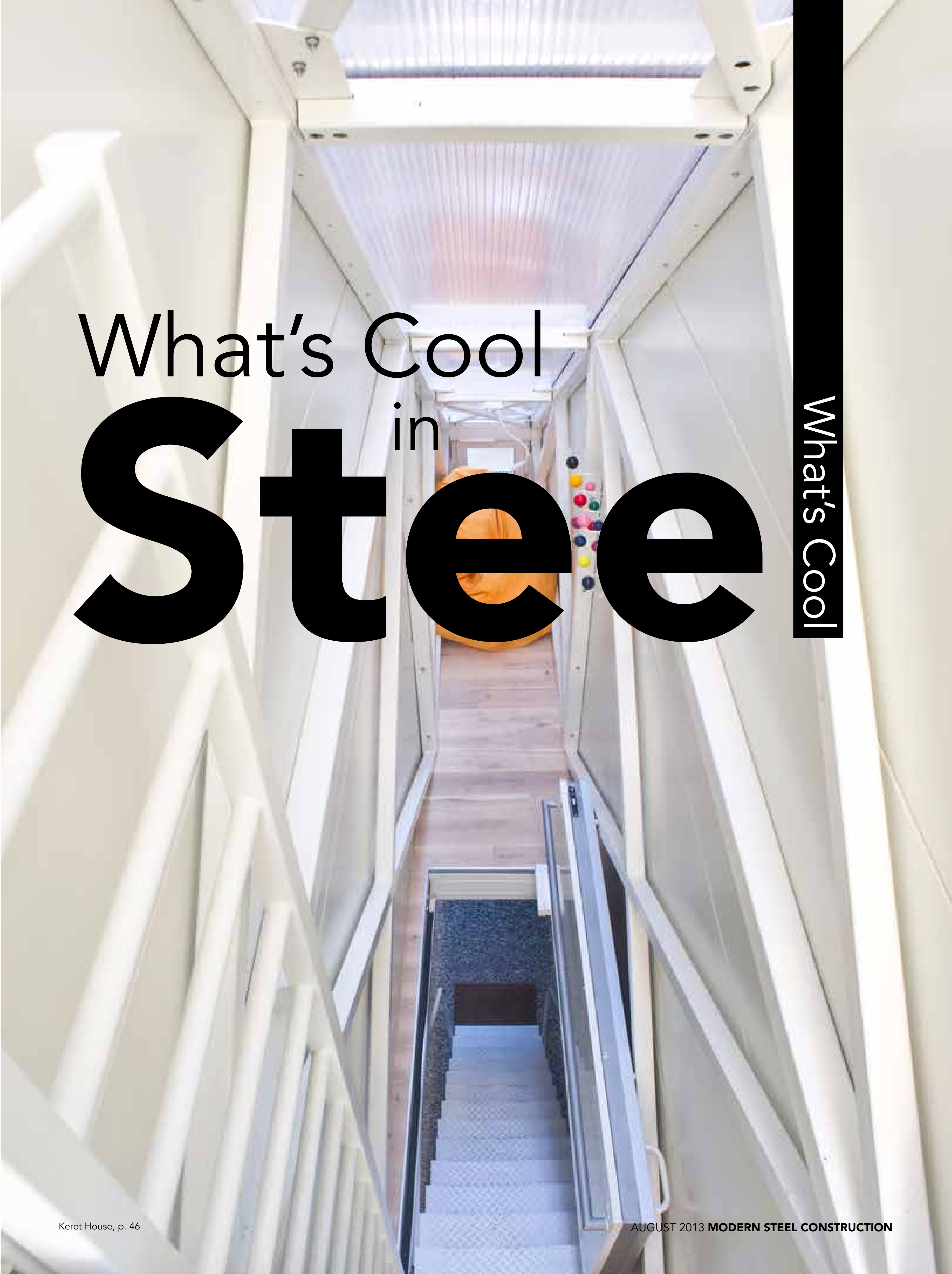
What’s Cool in Steel



Keret House, p. 46

What's Cool in Steel

Photos: Novum Structures

Cool Garden

Growing Glass

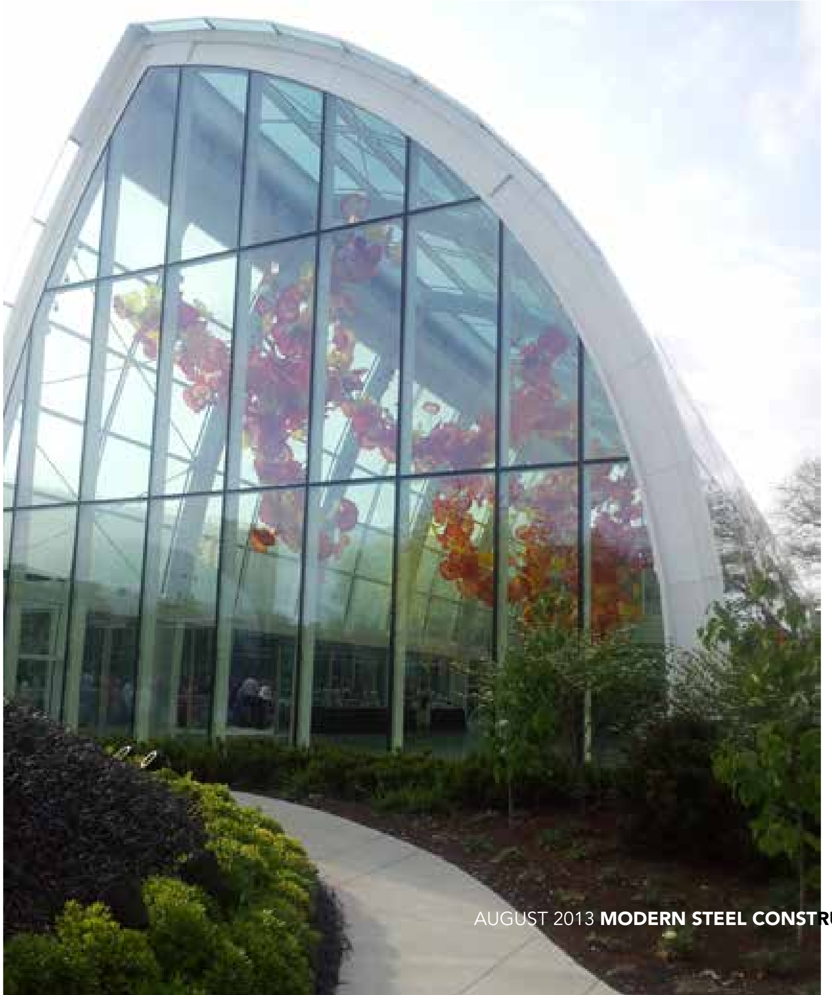
BY CHET FRIZZELL, NORTHWEST STEEL FAB, INC.

A GARDEN OF GLASS is blooming at the foot of Seattle's Space Needle.

Chihuly Garden and Glass, an exhibition exploring the career of Northwest artist Dale Chihuly, transformed 1.5 acres of asphalt into an outdoor garden. To mark the occasion, Chihuly himself dedicated the exhibition's centerpiece Glasshouse by signing and dating one of the building's structural beams.

Designed by Owen Richards Architects and Novum Structures, the Glasshouse, which is 40 ft tall and occupies 4,500 sq. ft, is framed with 90 tons of structural steel and houses a suspended 1,340-piece, 100-ft-long glass sculpture as well as the Garden, which serves as a backdrop for a number of monumental sculptures and other installations. The project consists of twelve W18×106 wide-flange columns or "ribs," while all of the support framing at the roof and end walls was fabricated from square and rectangular HSS. The glass connections, point-supported spider connections attached with rivet nuts, were prepared in Northwest Steel Fab, Inc.'s (AISC member/AISC certified fabricator) shop; everything had to be "handmade" with incredible accuracy due to the large number of glass connectors. In addition, the primary steel members could not be processed through any of the shop's automated equipment as they needed to be rolled. The steel components were all laid out by hand, and holes were manually drilled at the connection plates of the ribs.

Construction took only nine months and the project opened in May.



What's Cool in Stee

What's Cool

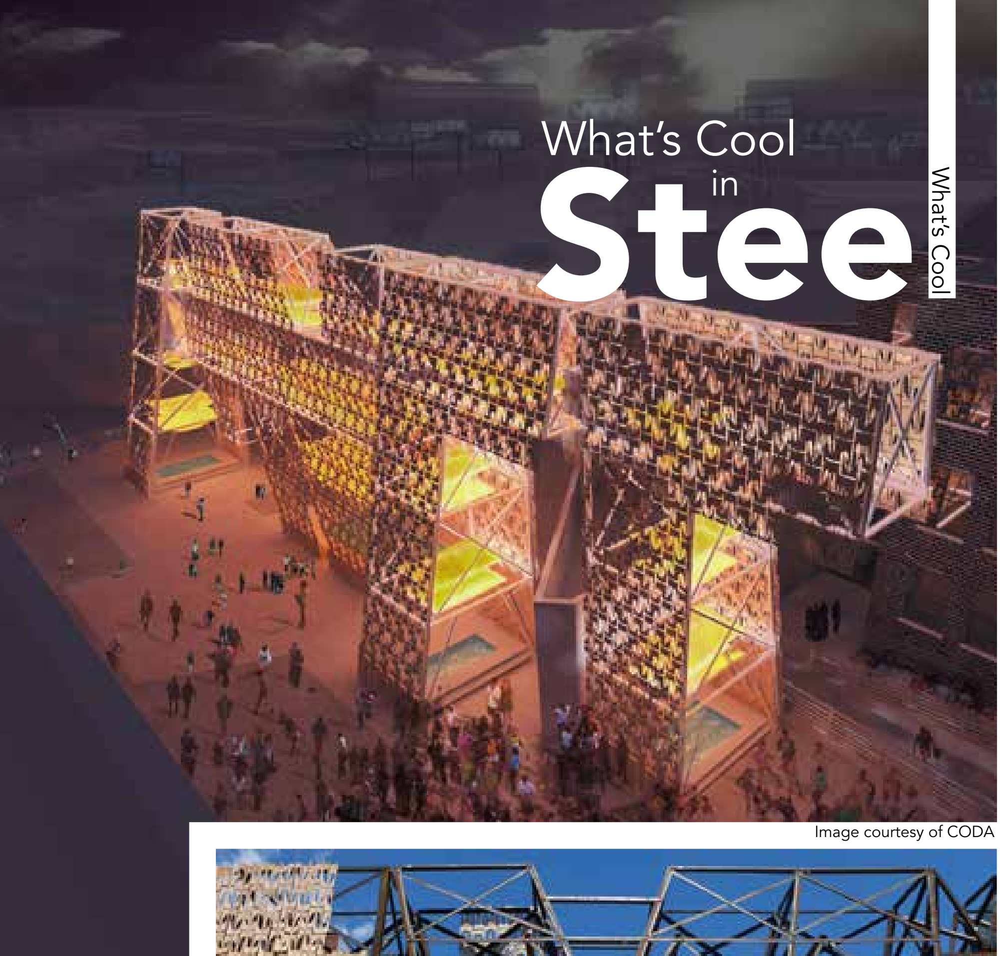


Image courtesy of CODA

Cool Shade

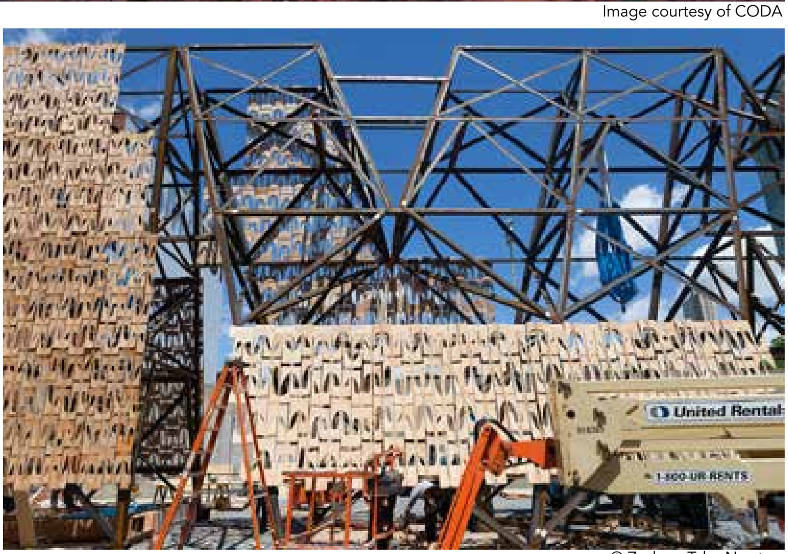
Winning Wall

BY CAROLINE O'DONNELL, CODA

PARTIES CAN'T LAST FOREVER—though their spirit can.

The same goes for *Party Wall*, a temporary pavilion in the courtyard of the Museum of Modern Art's (MoMA) PS1 facility in the Long Island City neighborhood of Queens, N.Y. The installation was the winning project in the latest Young Architects Program, an annual design competition hosted by MoMA that seeks to foster innovative design research and promote emerging talent. It was unveiled in June and will be on display until the end of August.

Designed by CODA, an experimental and research architectural studio in Ithaca, N.Y., and engineer Robert Silman Associates, the 37-ft-tall project is a vertical shade with a porous façade that is clad with a screen of interlocking wooden elements donated by Comet Skateboards, an Ithaca-based manufacturer of eco-friendly skateboards. Several of the panels are detachable and can be used as benches and communal tables. At the wall's feet, a series of pools are fed via a gravity-operated fountain that engages with the courtyard.



© Zachary Tyler Newton

Image courtesy of CODA

© Zachary Tyler Newton

It is held up by a structural steel frame fabricated by Banker Steel (AISC member and AISC certified fabricator); the frame, roughly 22 tons, is ballasted by large water-filled polyester-based containers that can be lit at night.

CODA's philosophy is that architecture should be reactive to context, just as an organism evolves in relation to its site. PS1's context has defined this project through analysis of the visible context: the walls and billboards that make up Long Island City's skyline; the climatic context: the rotation of the sun around the courtyard in the summer months; the new site boundary: the medium-sized courtyard being divided this year for an installation of another facility; the previous winners: which favor a horizontal canopy scheme in order to provide the "shade" required in the brief; and finally, the longstanding brief, which requests an "environmentally friendly urban landscape" that provides "shade, water and seating" as well as the request for a "flexible experimental space" for a diverse range of programs.

A shallow, grade-level stage weaves around the structure's feet, creating a series of micro-stages that reach out to the various sections of the courtyard and the dance floor. These stages can be occupied for various events using the benches that are detachable from the structure. Benches can be arranged in various scenarios depending on the event—not only can it accommodate various social events and visitors, but also lectures, classes, discussions, dining, performances, film screenings and even, perhaps, a wedding.

On the inside, the frame uses 513 steel members (mostly L4×4×¼ and some L6×6×⅜ for the legs) and 1,071 ¾-in. A325 tension control bolts, and was modeled and detailed in Tekla Structures (AISC member Datadraft Systems, Inc., was the detailer). All pieces had to be square cut, with no welded shop or field welding allowed, and only one bolt size was used throughout the framing system—and only one bolt was allowed per joint.

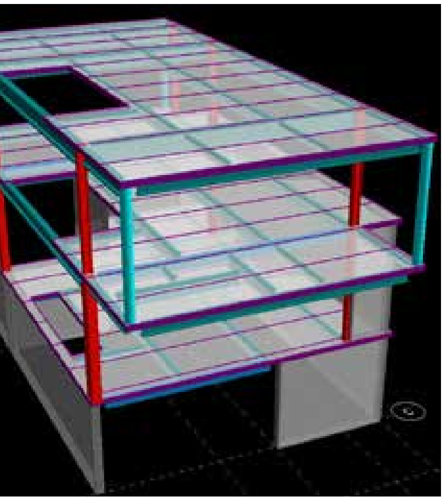
For more on *Party Wall*, see **www.codapartywall.com**.

What's Cool in

Steel

What's Cool

Photos: George Lambros/Lambros Photography



Cool Cottage

River View

BY CHRISTOPHER D. ROCKEY, S.E., AIA, ROCKEY STRUCTURES, LLC

18 GRAND BOULEVARD is indeed grand.

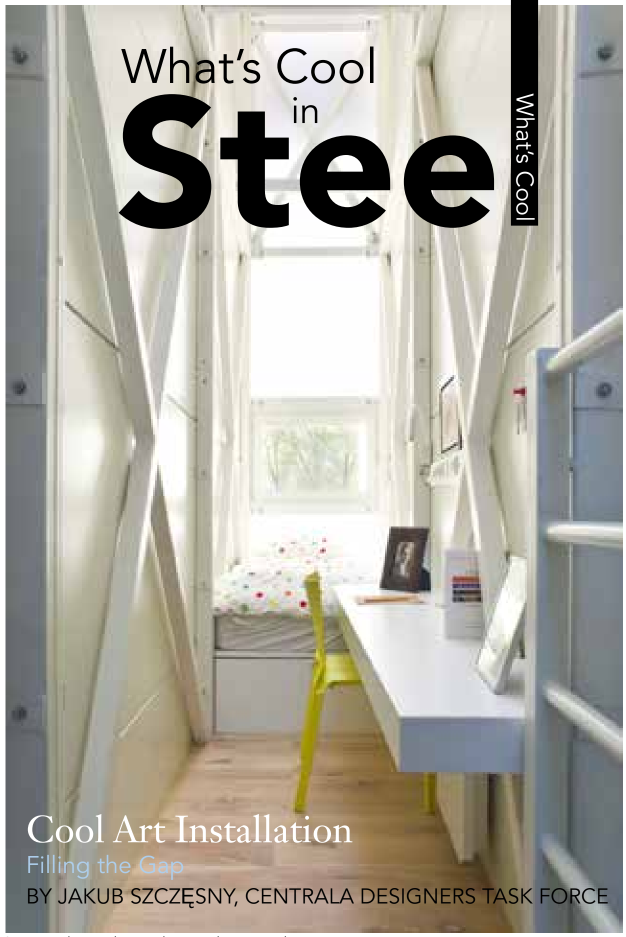
Built along the historic Black River in South Haven, Mich., this summer cottage inhabits the former site of a 100-year-old cottage that was lost in a fire. In the traditional context of a turn-of-the-century vacation town along Lake Michigan, the original cottage was constructed with wood framing, brought over from the lake's west coast as a kit home. In the rebuild, the lot presented construction challenges due to its relatively small size of 33 ft by 66 ft (the house itself is 30 ft by 55 ft) and limited "formal" access; it is completely landlocked on three sides and butts up against the Black River on the south, including a perpetual easement that limited the foundations to less than two-thirds of the site.

The new, steel-framed house (using 14.5 tons of structural steel) pays tribute to the river, which originally stimulated the growth of the town's first sawmill. Structural steel presented itself as the base building material early in the design phase of the project due to three primary reasons. First, the greater fire resistance of steel, in combination with concrete, provided an enhanced level of comfort to the occupants due to the fire that had taken the original structure. Second, it allowed for an open floor plan common to modern dwellings as well as provided for generous cantilevers at two ends of the residence. Finally, steel made sense from a logistical standpoint, thanks to the limited number of components, quicker construction time, tight site constraints and lack of easy access of material delivery.

The gravity system uses a composite floor system, with a 1½-in. deck and 2 in. of toping, which is stiffer than a traditional wood-framed floor, while the lateral forces are resisted by a combination of moment frames, braced frames and shear walls. The structural steel spans the length of the cottage and allows for the open floor plan, and by incorporating web penetrations the floor and ceiling sandwich was able to be kept to a minimum, allowing for taller ceilings while staying within zoning height limitations. The roof is framed with the same system as the floors, and the members are cantilevered 10 ft to the south, allowing construction over an Army Corps of Engineers easement and also providing shading for the deck below. The roof steel also cantilevers at the north end of the cottage, providing shelter for the entry and an outdoor dining area.

The new design incorporates new ideologies of openness, passive design, simple maintenance and access to the outdoors, while respecting the footprint of the original cottage and the geometrical zoning constraints. The owner, who acted as the architect and the structural engineer, facilitated the desire for openness by providing direct access to the outdoors from each of the four bedrooms at the second floor. Architecturally, the Ipe wood cladding, which was designed as a rain screen, sweeps continuously around the walls to provide a contrast with the base building materials. The harmony of all of these materials resulted in a contemporary statement along the more traditional setting of the riverfront.

What's Cool in Steel



Cool Art Installation

Filling the Gap

BY JAKUB SZCZĘSNY, CENTRALA DESIGNERS TASK FORCE

Images: Bartek Warzecha, Jakub Szczęsny, Simone de Iacobis and Piotr Zbierajewski

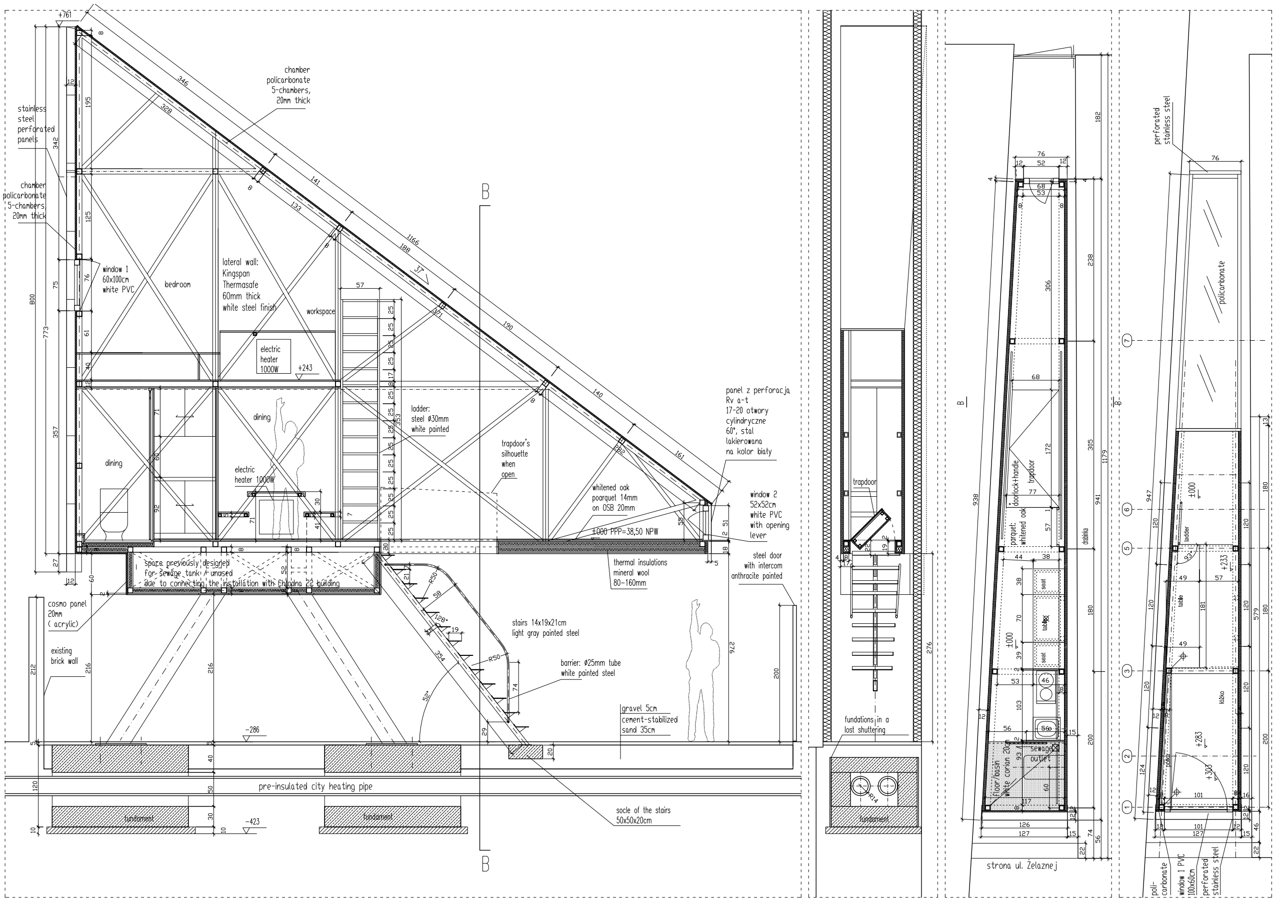
THINK YOU'VE HAD TO BUILD a project on a tight construction site? Think again.

The Keret House was built between two existing structures on Żelazna Street in the Wola district of Warsaw, Poland—in a space that's 5 ft at its widest point and 3 ft at its narrowest. The structure itself is approximately 46 ft tall and 4 ft at the widest point and 2.4 ft at the narrowest.

The idea for the house, designed by Jakub Szczęsny, was first pressented as an artistic concept during Warsaw's WolaArt festival in 2009, then became a reality last year. It serves as the workplace for Isreali writer Etgar Keret and also as a studio for invited artists. The program's goal is to produce creative work conditions, with the house serving as a significant platform for intellectual and creative exchange; the project will stand for at least two years, possibly longer. (Szczęsny is currently working on a parallel project in New York.)

The house is officially an art installation as its narrowness makes its acceptance as a building impossible. Steel-framed, it stands on two tunnel-like foundations, enabling city heating pipes to pass beneath it. The frame (which uses 3.15-in. by 3.15-in. and 3.15-in. by 1.57-in. HSS) is clad laterally with 2-in.-thick Kingspan sandwich panels filled with nano-foam for better fire and thermal protection, while the façades are made out of translucent 0.8-in.-thick polycarbonate, with two opposed windows for cross-ventilation. The house is supported on two approximately 1-ft-diameter steel "legs."

Access to the "living room" is granted through an exterior staircase and a trapdoor in the floor. An airplane-sized bathroom, a kitchenette and a dining space for two are also situated on this level. The sleeping compartment, with a 3-ft-wide matress and a work desk, is situated on a platform connected with the living area by a ladder. To avoid the claustrophobic effect of the narrow space, the exposed structure and side panels are white, with a large polycarbonate roof serving as a source of indirect light.


stainless steel perforated panels
chamber policarbonate 5-chambers, 20mm thick
chamber policarbonate 5-chambers, 20mm thick
window 1 60x100cm white PVC
bedroom
lateral wall: Kingspan Thermasafe 60mm thick white steel finish
workspace
electric heater 1000W
+243
dining
dining
electric heater 1000W
ladder: steel ø30mm white painted
trapdoor's silhouette when open
whitened oak poarquet 14mm on OSB 20mm
±000 PPP=38,50 NPW
panel z perforacją Rv a-t 17-20 otwory cylindryczne 60°, stal lakierowana na kolor biały
window 2 52x52cm white PVC with opening lever
steel door with intercom anthracite painted
thermal insulations mineral wool 80-160mm
space previously designed for sewage tank - unused due to connecting the installation with Chłodna 22 building
cosmo panel 20mm (acrylic)
existing brick wall
stairs 14x19x21cm light gray painted steel
barrier: ø25mm tube white painted steel
gravel 5cm cement-stabilized sand 35cm
-286
pre-insulated city heating pipe
fundament
fundament
-423
socle of the stairs 50x50x20cm
B
B
trapdoor
fundations in a lost shuttering
fundament
strona ul. Żelaznej
perforated stainless steel
policarbonate
poli-carbonate
window 1 PVC 100x60cm
perforated stainless steel

Photos: Courtesy of Jane's Carousel

Cool Carousel

Round and Round

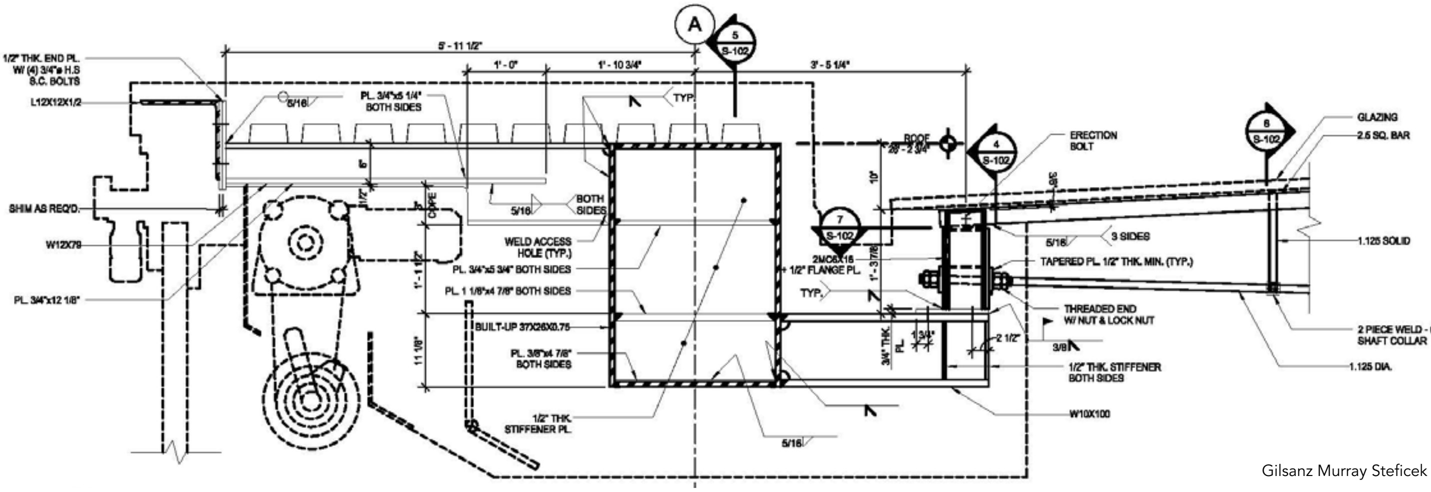
BY CARL ZANIER, P.E., AND RAMON GILSANZ, S.E., P.E., GILSANZ MURRAY STEFICEK LLP

JANE'S CAROUSEL has come a long way in its 90-plus years of existence.

The carousel dates back to 1922, when it was initially installed in Idora Park in Youngstown, Ohio. In the early 1980s, it was purchased for installation in Empire-Fulton Ferry State Park (now Brooklyn Bridge Park) in the Dumbo neighborhood of Brooklyn. Painstakingly restored by Jane Walentas over the course of more than two decades in her Dumbo studio, it now resides in a pavilion in the park and is the first carousel to be placed on the National Register of Historic Places.

The 5,000-sq.-ft, steel-framed acrylic pavilion, with a tensile roof structure, was designed by prominent French architect Atelier Jean Nouvel. Gilsanz Murray Steficek LLP (GMS) assisted the executive architect, TA Dumbleton Architect PC, in developing the foundation design, steel superstructure and structural support details for the clear wall panels, operable panels and tensile roof that form the pavilion.

The floor slab is concrete on metal deck; an access hatch between the spinning platform of the carousel and the stationary motor housing provides access to the mechanical space



Gilsanz Murray Steficek

below. Plates with shear studs were cast into the interior foundation walls and studs were welded onto the metal deck to enable it to act compositely.

The structure is supported on a raft foundation that floats on the site. The weight of the completed structure, with the 25-ton carousel installed, is less than the weight of the soil displaced by the structure below grade. With the organic fill soil profile of this site, the raft foundation was more economical than a pile foundation.

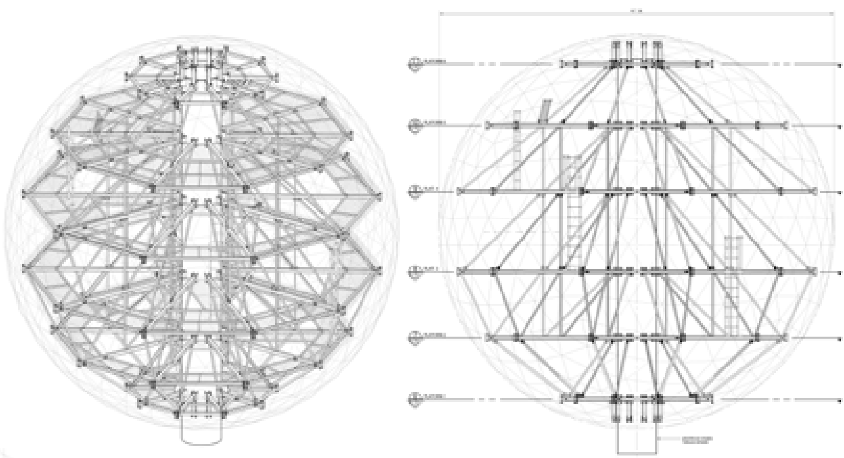
The four corners of the mechanical space are chamfered in plan, forming an octagonal space on the interior. These corners have 5-ft-wide diagonal walls forming the chamfer and provide piers in the foundations to support the four HSS24×0.500, ASTM A500-Grade B columns. These four columns are 27 ft high and spaced about 60 ft apart to support the the roof.

At the roof, the columns are moment connected to 37-in.-deep × 26-in.-wide box girders, creating the four sides of the pavilion. These box girders were designed to resist not only the vertical gravity loads, but also the tensile forces from the roof and the wind loads from the walls. The tensile roof is comprised of 1¼-in.-thick glass with a steel rod and strut support system. Coped W12×79 beams cantilever out from the box girder to support a continuous L12×12×½, which forms the frame for the operable doors. W10×100s cantilever in toward the center of the roof to provide a connection point for the tensile structure. Posting up at the end of each W10 are two MC6×18s, which support the curved HSS8×8×3/8 tension ring.

Two of the clear walls of the pavilion are 4½-in. acrylic, non-operable panels with a vertical span 27 ft; the panels are 10 ft wide. The connection at the base of the panels was developed to provide fixity, thereby limiting their deflections. The other two walls are made of operable 1-in. acrylic and slide open to provide access to the carousel.

What's Cool in Steel

Cool Light
Tall Ball
BY JACK LESTER, YESCO LLC



Photos: Michael Schoenfeld

BRIGHT LIGHTS are one of Atlantic City's defining characteristics.

But the Revel Atlantic City hotel and casino envisioned a lighting structure that would stand apart from—and above—all others. Sitting atop the 47-story hotel, the "ball" does just that. The 40-ft-diameter sphere, conceived and designed by Mitch Gorshin, Revel's executive director of fun and creative, in concert with Young Electric Sign Company (YESCO), shines like a beacon thanks to 250,000 programmable LEDs that are visible from 10 miles away.

The ball weighs 45 tons and is framed with hot-dip galvanized HSS including 48-in.- to 0.75-in.-diameter members. The ball, including electrical components and catwalks, was completely built at YESCO's Las Vegas location, then disassembled and sent to the site in 16 shipments. The LEDs are on 980 triangular skin assemblies, which were installed in the field from inside the ball using the catwalks.

One of the more difficult aspects of this project was developing the field connections and providing each stainless steel mounting stub at the correct location. At all points where the triangles connected, there was a six-point spindle similar to the hub of a car. These spindles then spun in six different directions at all different angles to the correlating hub. The cross connections for the hubs had 69 different lengths and needed to be placed in the correct position to allow the illuminated panels to "float" in their locations to compensate for expansion and contraction of the sphere. Each of the panels needed to be individually noted as to its orientation and LED count.

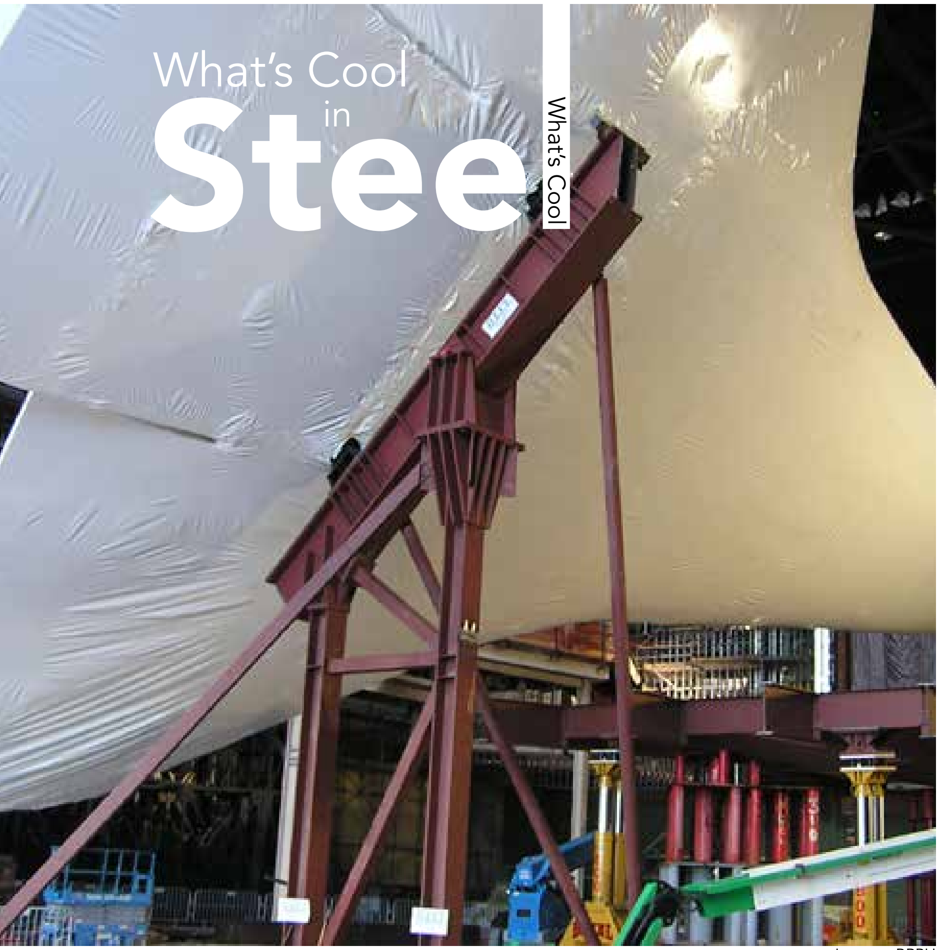
A tower with a capacity of 7 tons was used to lift the various pieces of the ball into place, with the heaviest piece being a 48-in. HSS. As the same crane was also being used to help erect the hotel tower, there was only a short time period in which the various components could be lifted to the roof, and YESCO worked closely with the general contractor to ensure that the ball made its erection window.

The entire facility was completed on schedule, in the spring of 2012, and the Revel's crowning achievement has served as an Atlantic City icon ever since the hotel opened—and survived Hurricane Sandy with no damage.

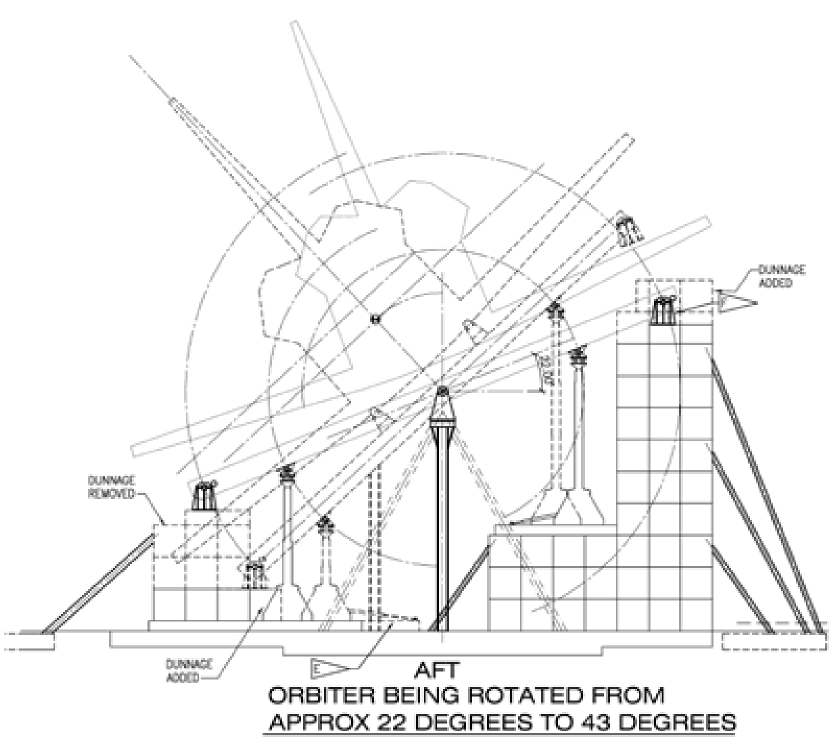
Cool Spaceship

Out of this World

BY ANDREW MILLER, NICK GIGANTE AND KEN PAQUETTE, BRPH



Images: BRPH



IN 2011, a chapter of the United States' Space Shuttle Program came to an end when NASA announced the retirement of its shuttle fleet.

Luckily, another began, one that would provide an opportunity for everyday citizens to get closer to these iconic space vehicles than ever before. One, Space Shuttle Atlantis, would be permanently located at Kennedy Space Center Visitor Complex on Florida's Space Coast and be displayed as the centerpiece of an interactive attraction devoted to the 30-year Space Shuttle Program. The experience provides guests with a nearly 360° view of Atlantis as only astronauts have seen it before, tilted on its side (and supported by a steel frame, fabricated by Industrial Steel, Inc., an AISC member and AISC certified fabricator), seeming to float in space with its payload bay doors open and its robotic arm extended, as if it has just undocked from the International Space Station.

BRPH was tasked with providing civil, structural, MEP, electrical plumbing and fire protection for this $100 million, 90,000-sq.-ft project, with the work broken into stages. The 82.5-ton shuttle would be displayed tilted at 43.21°, but the structural team was tasked with a lot more than simply creating a framing system for the retired spaceship. It also had to plan how to transport it to the Visitor Complex, get it off the transporter, lift it 30 ft in the air and rotate it.

An initial report called the "Atlantis Support Concept" was produced to define the basic methods for transportation and installation. First, we had to define how we were going to transport the orbiter 10 miles from the Vehicle Assembly Building at Kennedy Space Center (KSC) to the Visitor Complex. We looked at providing support through special stands on a modified or different transporter to see if they would simplify the installation in the new building. After much testing and configuration, it was decided to support the structure as normally done on the 76-wheeled Orbiter Transporter System (OTS) that had been used throughout the shuttle program.

After this critical step, we needed to define the hardware that would be used to support the orbiter on support frames. Since these were unchartered waters, we didn't know at first what the differences in the hardware were for vehicle support on the ET (External Fuel Tank) or support on the OTS or on the Boeing 747 that was used to fly space shuttles back to KSC during alternate landings. A custom forward connection had to be fabricated since this project was so specialized.

Next, BRPH produced another study called "Atlantis Loads Assessment" to see if the orbiter loads were below published capacities that the 747 hardware was designed for when oriented at 43.21°. We settled on support frames that satisfied NASA's requirements and simplified the foundations and the support frame because there was no need to develop bending moments.

As we were discussing ways to get the orbiter into the new facility, we had to contend with restrictions imposed from the already in-place building structure. At the time, we knew that the orbiter had to be moved farther north than was possible by simply moving the orbiter straight into the building. It looked like the

orbiter support structure would need to "crab" over. To make this happen, one of the build team leaders drove the OTS and moved the vehicle farther west than the final display location and then backed it into its final position.

Next came removing the support structure from below the orbiter. The vehicle's forward and aft landing gear had to be extended down. To get the support structure out, special jacks used for processing the vehicle supported the forward end. The OTS is able to change heights, so with the landing gear lowered, the OTS bed was lowered and then rolled out of the building. Once in place, connections had to be made. We had to design a spacer that would allow for the installation of the bases and connect to the main orbiter aft support beam. To allow for movement and support in the directions required, as derived from our study, slide bearings were used to allow movement and to allow the orbiter connections to bear at required points.

One of the "wow factor" elements of the visitor experience is seeing the shuttle rotated as if it is flying in space. This became one of the most interesting components of the engineering process. We knew that the forward landing gear was very close to the forward connection point, and that the forward support beam was not going to fit with the landing gear down. What we didn't know is that all of the landing gear needed to be raised at one time until late in the design. This meant that the steel support frame needed to be installed in pieces.

We also made models of the support frame rotated at different angles, with different support conditions to create an envelope of possibilities. We didn't know if the main hinge column would consistently be supporting load, but we did know that it would be best if it could support the load.

BRPH designed a test fixture that simulated the orbiter weight and center of gravity that was supported on the same lift and rotation frame and orbiter connection hardware interfaces. The test revealed some additional issues that needed to be considered. Surveyors were on-site to monitor that the forward and aft were being moved up level. The orbiter/support frame structure was moved vertically in 2-in. increments. One of the last pieces was the removal of temporary HSS and W-shapes from the support frame after the additional permanent framing was installed.

The permanent beams at the forward and aft Orbiter connection points are double side-by-side W30x173 members with their top and bottom flanges welded together and covered with 1-in.- thick welded cover plates at the tops and bottoms. The permanent columns at both ends are W14x176. The test fixture uses approximately 16 tons of steel while the support structure uses approximately 123 tons. MSC