Barclays Center
Facade

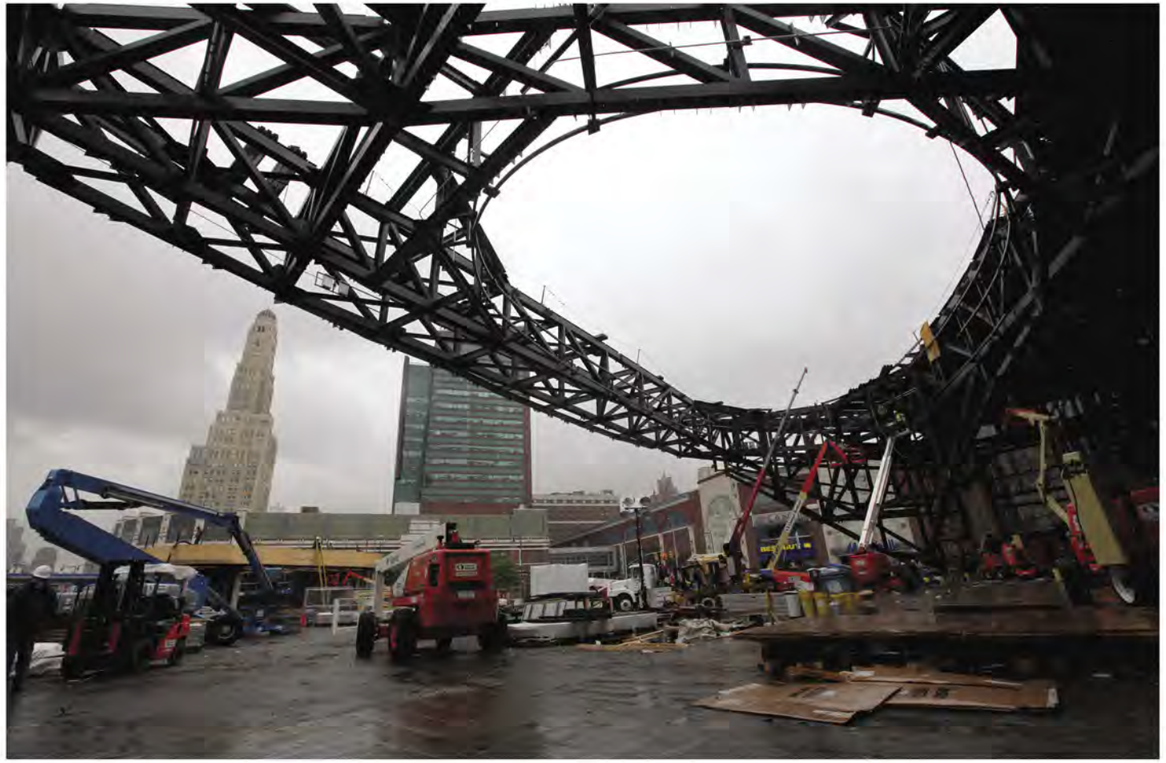
A pre-weathered steel shroud for Brooklyn's new arena took shape with parametric design software that links architectural forms with advanced fabrication techniques.

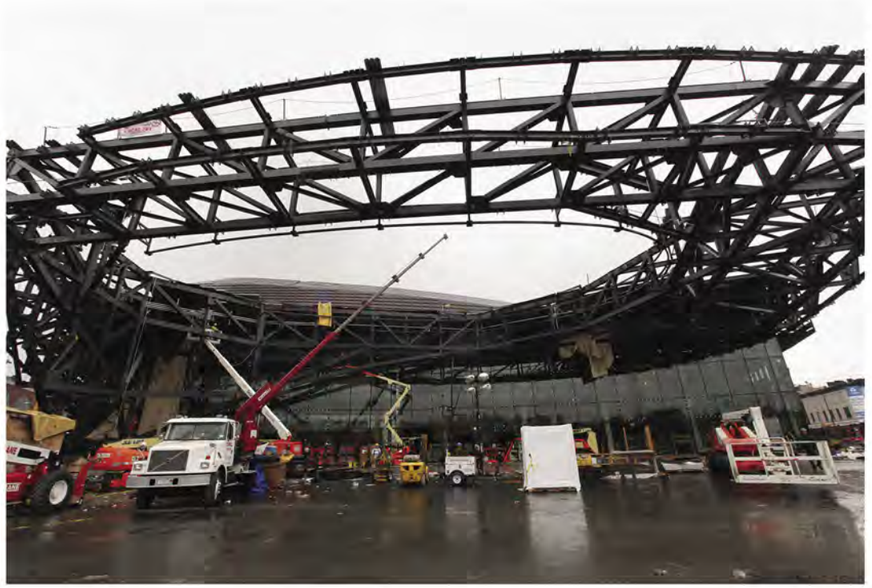
THE LATTICEWORK OF nearly 12,000 unique panels of pre-weathered steel arrayed around the swooping exterior of Barclays Center—Brooklyn's new 19,000-seat multi-purpose arena—is a daring symbol of how much one of New York's most well-known boroughs has changed. Consciously integrating elements of gritty, urban context in a sophisticated modern shape, the sculptured facade is both a nod to the creative class increasingly choosing to live in the arena's adjacent neighborhoods, as well a reminder of Brooklyn's industrial past.

The architectural firm behind the facade, New York-based SHoP Architects, has over the years honed a precise, mathematically rooted approach to digital fabrication and mass customization on a number of well-regarded buildings. However, none of those projects has approached the size of the 675,000-square-foot Barclays, the new home of the Brooklyn Nets basketball team and one of New York City's largest performance venues.

Jonathan Mallie, an architect and the principal in charge of the project for SHoP, says the challenge of integrating such a large project into the existing neighborhood scale was a foremost concern. "With the arena bowl and building sunken 30 feet below ground, the verticality of the structure was already broken down," Mallie says. "We wanted to further break it down by wrapping it in horizontal bands."

Diagrammatically, the Barclays exterior consists of three primary elements using both the steel panels, which cover 85 percent of the facade, and an otherwise conventional glass and aluminum curtain wall system. A top band of steel panels acts as what Mallie describes as a "halo" ringing the arena's roof. A second, lower band of panels skirts closer to the street level and then sweeps up at the main entrance at the northwest corner of the site at the intersection of Flatbush and Atlantic avenues. At this raised point, the lower band cantilevers out as a canopy structure toward an entrance plaza that visually links to the newly created MTA transit station with connections to several of New York's subway lines. As a public gesture, the canopy opens up with an 110-foot-wide, 60-foot-deep oculus internally ringed with an LED screen that has become an inescapable presence in the area at night. Behind the flowing waves of steel, the clear insulated glazed units of the curtain wall reveal the internal functions of the Barclays, allowing a surprising number of views directly into the arena and even of the massive scoreboard at the center of it all.

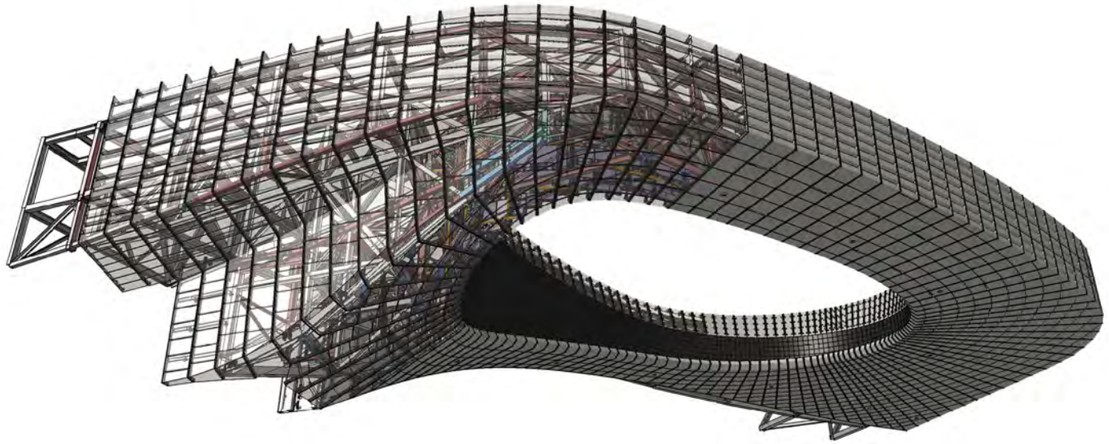


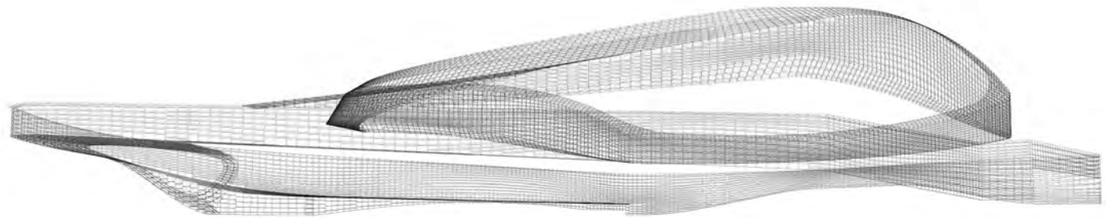


This page The center's cantilevered main entrance canopy is supported by two 12-foot-6-inch-deep primary trusses joined with diagonals, creating boxed trusses that tie back into the superstructure's columns.
Facing Design architect SHoP's diagrams of the 110-foot-wide, 60-foot-deep entrance oculus (top) and panel system (bottom).

Bess Adler/Thornton Tomasetti; opening spread: Bruce Damonte

SHoP Architects





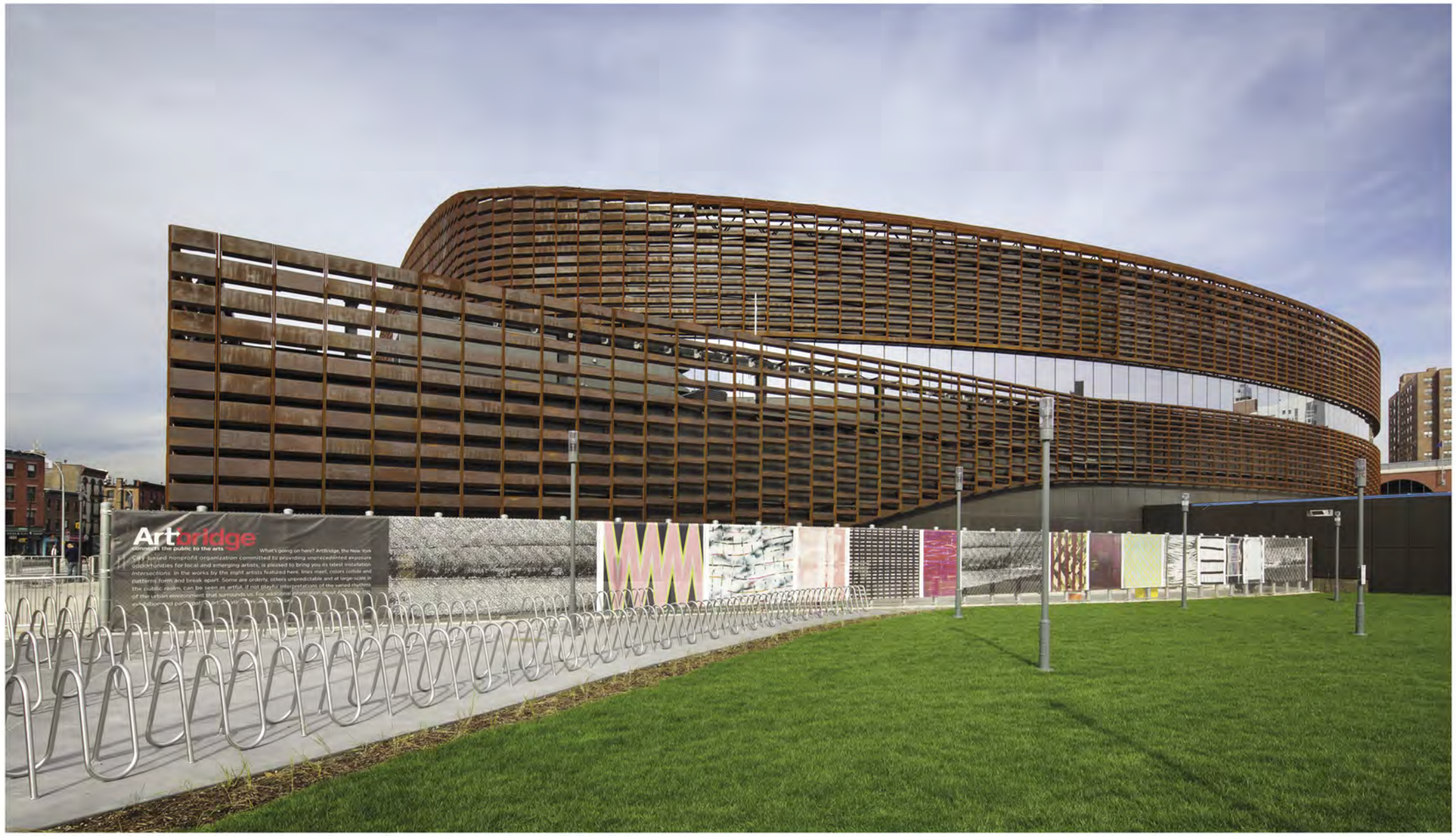
The architects further broke down the scale of the structure by adopting the lattice-like construction of steel panels, with 45-degree-bends in the 3⁄16-inch-thick steel that create a shadowbox effect and which multiply the dynamic effect of the building's curves. Mallie says this effect helps to lead visitors' eyes down the street, as opposed to staying focused on a static object in the urban landscape. The A588 COR-TEN steel—a high-strength, low-alloy steel the architects sent through a three-and-a-half-month weathering process to form a dark, brownish rust out of respect to Brooklyn's long history as a shipyard—was milled in Alabama and fabricated in Indianapolis. Each panel is approximately 5 feet wide, but they range from 9 inches to 60 inches in height. Every third panel on the facade is also embedded with a white LED lighting system, which has the effect of making the otherwise heavy steel appear to dematerialize at night.

The steel panels are bolted to pre-weathered steel structural channels, which rest on painted steel structural trusses, approximately 72 inches deep, which attach directly to the curtain wall system of Viracon glass units and Alucobond metal panels. The weathering was achieved with a process in which each panel was exposed to up to 16 wet–dry cycles up to a total of 1,000 cycles, all of which approximated a nearly six-year natural weathering condition. This controlled oxidation process should prevent the panels from further rusting in place and leaking brown stains onto the sidewalk around the Barclays, since oxidizing the exterior of the panels will, in effect, shield the core of the panels from continued oxidation and corrosion. The panels also act primarily as a rain screen cladding, so any deterioration would not affect the structural integrity or weatherproofing of the envelope behind.

At a minimum, there were approximately 20 steel panels attached to 10-foot-wide by approximately 15-to-40-foot-high sections of the unitized curtain wall to form an entire "mega-panel," as the architects call them. Each of the 950 mega-panels was prefabricated, shipped directly to Brooklyn, and installed onto the building's steel structure with curtain wall anchors. No individual steel panels had to be hung on site.

Originally, Barclays was to be designed by Gehry Partners. Thornton Tomasetti (TT), the project's structural engineers, had worked on the Gehry scheme before SHoP came on board in 2009. SHoP also worked with the Barclays architect of record, Ellerbe Becket Architects and Engineers

Above Panels cover 85 percent of the arena's facade. The steel shroud helps to break down the scale of the 675-square-foot building.



Above Internal truck elevators and turntables eliminated the need for ramps to loading docks, allowing the arena to have more of a storefront presence in downtown Brooklyn.

(now AECOM), on the design of the interior public spaces. Because the primary structure of the arena was already well understood in terms of the size of the bowl and structural system of steel (see the related story on page 16 of this issue), TT had to quickly respond to the loading requirements of the new facade.

Jeff Callow, a structural engineer and TT's project manager for Barclays, says the pre-weathered steel panels are basically a second skin on the building. As a result, TT's engineers had to increase the size of the primary structure's steel spandrel beams. The elegant swells of the top band, or halo, also demanded a supplementary cantilever structure on the building's west side that extended approximately 20 feet from the top of the arena bowl structure and 20 feet out. The cantilever consists of extensions to the arena columns that in turn support trussed vertical frames with horizontal tube steel girts that hold the panels in place. There is also an 85-foot cantilever with boxed trusses at the main entrance for the canopy oculus.

SHoP developed a 4-D model of the project that married the building geometry to the construction schedule established by the Hunt Construction Group, the design-build contractor on the Barclays for developer Forest City Ratner Companies (FCRC). The geometry was created using Rhinoceros software and then digitally represented in a CATIA model, which is parametric design software that links architectural form-making with advanced fabrication processes. The architects created so-called "document templates" that act like computer scripts and write the logic of the panel construction across the geometry of the building. For each panel, the templates determine how the steel must fold, where the slots for bolting the panels must reside, the manner in which joints would align and be outwardly expressed, and how the panel would hang given the dictates of the building form.

This spread: Bruce Damonte

BARCLAYS CENTER FACADE

Location: **620 Atlantic Avenue, Brooklyn, NY**
Owner/Developer: **Forest City Ratner Companie**s, *Brooklyn, NY*
Lead Architect: **AECOM**, *New York, NY*
Design Architect: **SHoP Architects**, *New York, NY*
Structural Engineer: **Thornton Tomasetti**, *New York, NY*
Mechanical Engineer: **WSP Flack & Kurtz**, *New York, NY*
Construction Manager: **Hunt Construction**, *Brooklyn, NY*
Curtain Wall Consultant: **Front Inc.**, *New York, NY*
Structural Steel Erector: **James F. Stearns Co., Inc.**, *Pembroke, MA*
Miscellaneous Iron Erector: **Berlin Steel**, *Kensington, CT*
Architectural and Ornamental Metal Erector: **Harriott Contracting**, *Columbia, MD*
Curtain Wall Erector: **Egan Architectural**, *Yonkers, NY*