MSC

MODERN **STEEL** CONSTRUCTION

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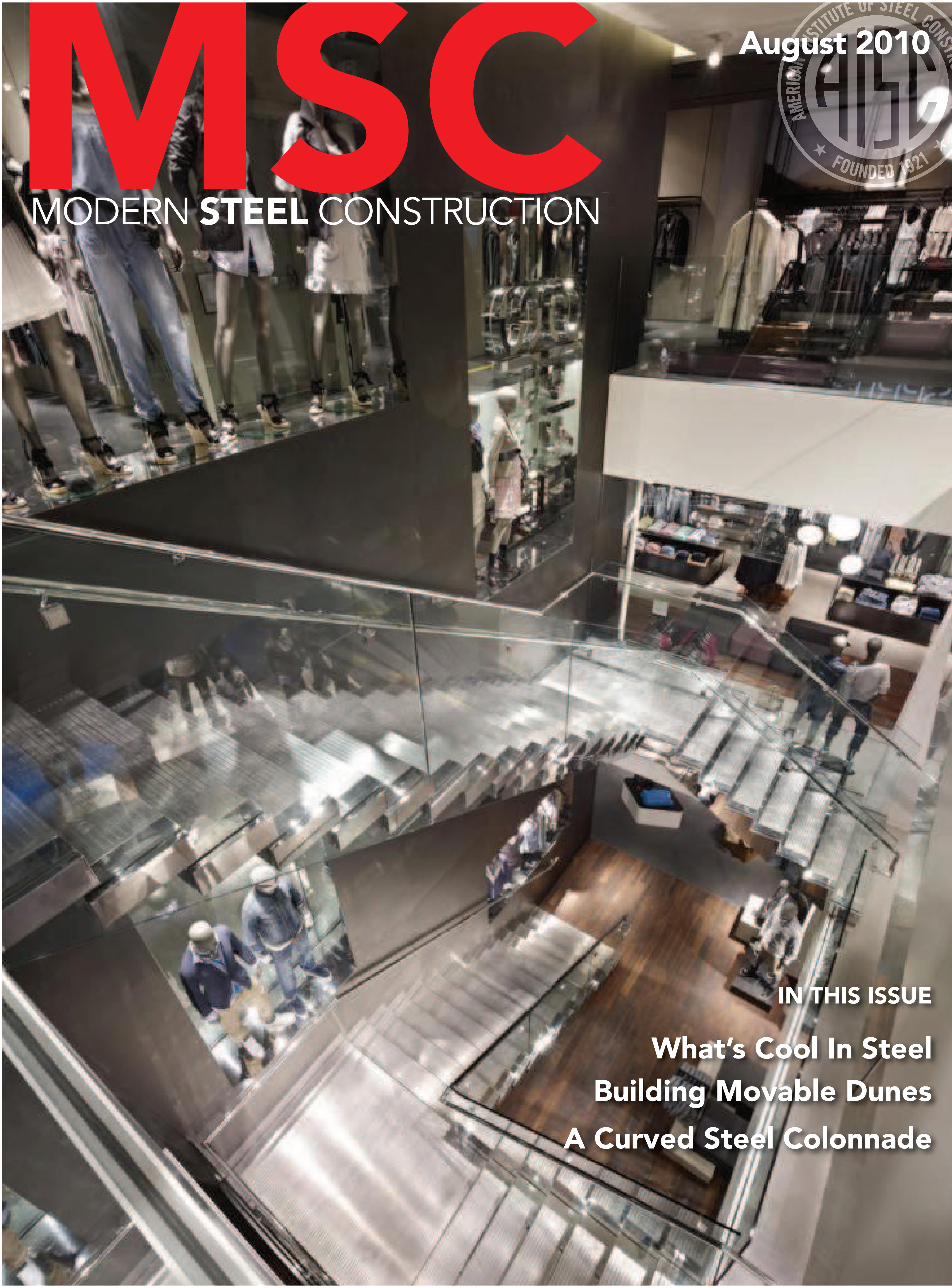

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What's COOL in STEEL?

Photo courtesy of Esprit Corp.

THREE NEW AND UNUSUAL PROJECTS demonstrate the lighter side of steel, even where there's serious structural work to be done. A stunning stairway in New York, a wild and wonderful climber in Phoenix, and a treetop playground in Philadelphia all use steel both to support and to delight.

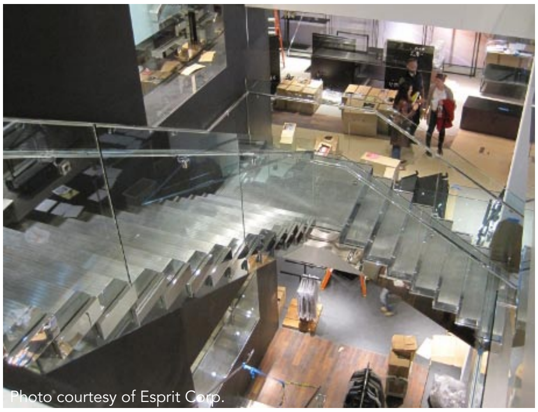
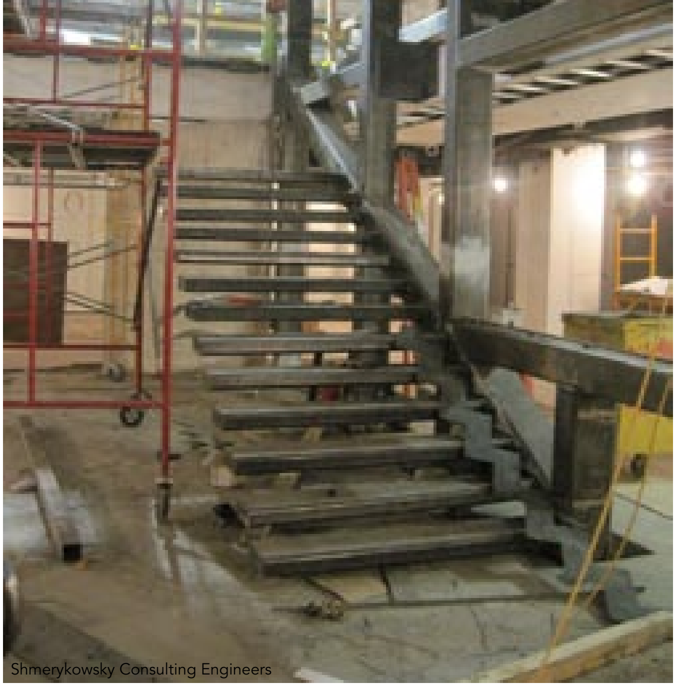


Photo courtesy of Esprit Corp.



Shmerykowsky Consulting Engineers

Cantilevered HSS stair treads provide a stunning look at the center of Esprit's flagship store in Manhattan. The stairway is supported by the HSS wall framing, and in turn supports glass panels with built-in handrails. To see more phtots of this project, visit **www.modernsteel.com/photos**.

INDIVIDUALLY CANTILEVERED HSS TREADS MAKE FOR ONE VERY COOL NEW YORK STAIRWAY.

Take the Stairs

BY MARCO SHMERYKOWSKY

FLAGSHIP STORES in midtown Manhattan are designed to impress. The Esprit flagship store, which opened its doors in March, is no different. Esprit and architects Barteluce & Associates chose an eye-catching feature wall and monumental stair, lit and looming at the heart of the new store. Shmerykowsky Consulting Engineers, design engineer of the base building that became home to the new store, was chosen to tackle the tough task of turning an inventive, appealing design into a structurally sustainable reality.

The base building includes three floors—cellar, ground and second. The team at Barteluce & Associates imagined open bays at the center of the ground and second floors, through which a stainless steel-clad monumental stair would rise from the cellar to connect each floor with the next. Anchoring this stair would be the "feature wall," a 25-ft-wide steel-framed structure rising approximately 40 ft and in which glass panel display cases would be embedded to show off Esprit's latest wares. The symbiotic unit of stair and feature wall—an amalgam of stainless steel, clear glass, and gray steel plate—would evoke, in miniature, the sleek modernist look so ubiquitous among New York high-rises while retaining the functionality essential to any retail space.

The stair was to zig-zag up from the cellar, with one flight running east-west to an intermediate landing then another flight running north-south to reach the ground floor. At the ground floor, a north-south flight would reach an intermediate landing between the ground and second floors before another flight running east-west reached the second floor. For the east-west runs, hollow structural sections (HSS) served as the treads. Along this run, each individual HSS tread would cantilever out from the feature wall. These cantilevered treads would be essential to the visual appeal of the stair, creating a gravity-defying illusion of one step floating above another.

Glass panels with built-in handrails would sidle up to the east-west stair runs on one side while the feature wall (with its own built-in handrails) would block off the other. The north-south runs took a pair of glass panels: one that would run continuously from the far edge of the intermediate landing and another that would frame a 90° angle with the single east-west run panel. Glass railings would also surround the open bay at the first and second floors.

Every trace of artifice, every seam, every bolt and rivet and weld was to vanish beneath glossy cladding. It was all going to look so easy, a leisurely little revolt against Newton. But, as anybody in construction can tell you, make no mistake, there's nothing harder than making it look easy.

The toughest question for the engineers? How to support that all-important monumental stair through the feature wall. But that wasn't the only problem. Millwork designed to encase the structural frame was to extend beyond the footprint of the slab opening. Differential deflection between the slab and the stair could potentially damage the proposed millwork. To address this issue, the engineers decided to connect the feature wall to the structural framing at the ground and second floors. Although these connections, which were engineered between the W21×62 girders and the structural frame's HSS posts, would help to minimize the differential movement between the two structural systems, they also would have the effect of transferring loads from the ground and second floors through the structural frame to the foundation. Thus, designing the stair structure meant starting from the bottom up.

With the base building supported on a pile foundation, spread footings were out of the picture. Enter three new concrete grade beams: a 2-ft-wide, 3-ft, 6-in.-deep cast-in-place concrete grade beam which spans approximately 25 ft in the east-west direction, supported by two additional 3-ft-wide by 3-ft, 6-in.-deep concrete grade beams which span in the north-south direction between the existing pile caps. The load-bearing capacities of these new beams would later allow for the engineering of connections which would reroute loads from the ground and second floors to the foundation, thus neutralizing potential differential deflection.

Next up was reframing the bay in which the stair and feature wall were to be placed. The original plan of the base building consisted of a column grid that established framing bays approximately 25 ft by 25 ft in plan, while the architectural design called for a 24 ft by

16 ft open atrium space. To create this new bay, existing W16×26 floor beams were cut at the ground and second floors. These floor beams were re-supported on new W21×62 girders that spanned between the existing wind girders located on the column lines.

Engineers also had to account for the glass railings designed to surround the new bay. At the slab edges on the ground and second floor, a series of segmented bent plates were engineered to extend the floor slab from the beam centerline up to the required opening edge as defined by the architect. A continuous angle was attached to these bent plates using a full penetration groove weld to support the glass panel's mounting shoes. Special attention was given to the welding details to allow the mounting shoe to achieve a tight fit within the limitations established by the architectural requirements.

The five HSS 12×8 posts of the feature wall's structural frame bore on the smaller aforementioned concrete grade beam, using base plates and anchored bolts. To guard against the possibility of differential deflection, these posts were connected to the new W21×62 girders at the ground and second floors. Vertical elements were crisscrossed with HSS 12×8×¼ members, providing structural docking bays for the stringers of the north-south stair runs and also framing space which would eventually be enlivened with display cases.

But most important were the HSS 12×12×⅝ support sections that would support the cantilevered treads of the east-west stair runs between the cellar and ground floor and between the ground and second floor. These sections do the kind of structural work solo that's usually reserved for pairs, ensuring that cantilever deflections would be limited under both superimposed dead and live loads. Every other element in the structural puzzle, every other support, was designed to accommodate these stringers. The HSS 12×12×⅝ support sections, and by extension the monumental stair, defined the engineering of the feature wall, not the other way around.

To provide lateral resistance, a single C12×27 member was installed at the roof level, spanning the entire 25-ft width of the frame and connected to the bottom flange of each beam it passed. With its web horizontal, the C12×27 connects to the HSS 12×8 posts by a series of vertical slotted holes, accommodating the roof beam deflection while also providing lateral support for the feature wall.

With the structural frame ready, so came the treads. The cantilevered HSS 12×4×½ treads for the east-west runs were perhaps the most critical element of the architectural design. The fabricator went to great lengths to ensure that each of these HSS tubes was precisely wrought. An all around bevel weld would connect the treads along the east-west run to their stringers, which meant that the tip of each HSS would have to align flush with the edge of the stringer. Precise welding sealed the deal.

For the north-south runs and adjoining intermediate landings, a trio of HSS 5×3×½ stringers was pressed into service. More conventional than their east-west counterparts, the north-south runs are supported by a pair of HSS 12×8×¼ girders lined up with the structural frame of the feature wall and the W21×50 wind girder in the ground floor slab. The ¼-in. bent plates that would serve as steps were then welded to triangular pieces attached to the girders to ensure that they remain level. And with treads attached, and some cladding here and there, well, that was that.

Even with all the technical details revealed, all the hows and whys answered, by their appearance alone the stair and feature wall still manage to awe. That's making an impression.

Marco Shmerykowsky is a principle engineer at New York-based Shmerykowsky Consulting Engineers.