New York City's subway system is a wonder of the world—which most riders take for granted. At the new Fulton Center in Lower Manhattan, a single escalator ride can remind even the most jaded urbanites of the marvel at their service.

FROM JOHN STREET, VISITORS CAN enter the Fulton Center pavilion via the Romanesque Revival-style Corbin Building. There, they reach a concourse underneath Broadway via a 30-degree wellway that cuts a section through the basement and sub-base- ment of the 125-year-old building, revealing inverted masonry arches that distribute superstructure loads more evenly. Commenting recently in The Guardian, Jimmy Stamp wrote that the escalator journey makes available to the public a “beauty of construc- tion that can be found nowhere else. This short descent makes you feel the weight of the building and realize the incredible feat of engineering that is the New York City subway.”

Adapted as an extension of the Fulton Center pavilion, the Corbin Building contributes multiple meanings to the wider project. The eight-story landmark is an aesthetic foil to the Grimshaw design next door. Once widely known as the “father of the skyscraper,” the building also preserves Lower Manhattan’s complex urban fabric. And, designed by Francis Hatch Kimball for Long Island Rail Road president Austin Corbin, the building helps the Fulton Center capture the full spectrum of New York’s transportation history.

Yet initial plans for the Fulton Center had targeted the Corbin Building for teardown. In 2003 MTA Capital Construction appointed Arup as prime consultant for the Fulton Center, and the multidisciplinary engineering firm hired Page-Aymes Cowley Architects to document the Corbin Building prior to demolition. This research disinterred rich memory from underneath years of neglect, which contributed to the proto-skyscraper’s addition to the National Register of Historic Places later that year.
Above A section of the Fulton Center and the adjacent Corbin Building. Left: An interstitial building ties the Fulton Center to the historic Corbin structure. Above left: Within the pavilion, the outer branches of V columns support the pavilion roof, while the inner branches support the oculus and frame the center’s dome. Above right: A circulating stair connects the center’s shopping and dining venues. Grimshaw and Arup’s scheme for the overall Fulton Center was revised, to save the high-rise. In order to fully integrate into the transit node, the Corbin Building would perform as the southern entrance to the Fulton Center and include the plunging escalator, among other functions. Allocating those roles to the structure meant first updating it to current codes and standards, says Arup principal Craig Covil, noting, “When the Corbin Building was designed 125 years ago, the New York building code did not have chapters concerning seismic or wind loading.”

The Corbin Building forms a 152-foot-long narrow wedge shape whose major axis runs north to south, and which measures 40 feet at its widest point. Structurally, it comprises a gravity frame of cast-iron columns and wrought-iron beams supporting Guastavino tile-arch floors. While columns are embedded within the building envelope, the facade is self-supporting masonry, with self-supporting cast-iron bay windows on the south and west elevations.

Unreinforced masonry is the source of lateral stability in a historical building like the Corbin tower, and due to the 20-foot width of the west elevation, as well as its abundant fenestration, Arup identified this side of the building as a particular weak spot for lateral load. It also found that the new functions required of the Corbin Building’s adaptive reuse could compromise the structure further. In a 3-dimensional ETABS model, for example, Arup demonstrated that penetrating the north elevation to link to Fulton Center new construction overstressed the masonry. The escalator wellway—the realization of which would require removal of parts of the street and two basement levels, all within liquefiable soils—also posed adverse effects to the south masonry retaining wall.

To resist north-south loading, the Arup team decided to link the Corbin Building’s destiny to the new construction. Instead of creating lateral load structure within a small historic footprint, it ties levels 2 and 3 of the Corbin Building to the Fulton Center via an interstitial building. Set back slightly from the Broadway street wall, the interstitial building features a structural steel grid of wide-flange steel sections consistent with ASTM A992 standards rising the full height of the Corbin Building. Covil refers to the seemingly separate volume as a “spine.”

During construction, steel integrity ties consisting of 8-by-4-inch double angles were installed in a north-south direction between opposing piers. These angles were required to resolve the lateral thrust of the inverted arch foundations during ex-
cavitation of the adjacent lot. In preparation for the transit center’s construction, engineers underpinned the western end of the building. These portions are supported on reinforced concrete walls cast beneath the existing shallow foundation.

For additional support, Arup applied a seismic upgrade technique to the north-elevation masonry between datum and level 2. Crews encased the wall in 4 inches of reinforced shotcrete and attached it to the existing masonry via L-shaped reinforcing bars in a 2-by-2-foot grid. To stiffen the Corbin Building above level 3, a concrete moment frame distributes lateral loads to the Fulton Center ties below, and connects to the interstitial building directly in accordance with system modeled after springs.

Arup produced these solutions in tandem with its development of the escalator void. To realize it, the design team revisited initial plans for full-block new-construction at the northeast corner of John Street and Broadway. When the Corbin Building earned historic status, the design team revisited initial plans for full-block development.

Above: Arup demonstrated the construction’s feasibility with a 3-dimensional ETABS model.

Facing: The interstitial building under construction at the northeast corner of John Street and Broadway. When the design team revisited initial plans for full-block new-construction for the project, they may have been unaware of the feat of engineering that has brought them here.

To bring Fulton Center to life is within the pavilion, where V columns comprised of wide flange column sections rise to support the second and third floors of the “donut” surrounding the central atrium. The outer branch of each V column terminates at the pavilion roof, while the inner branch rises to support the oculus, and frame the dome beneath. Moment connections between gravity columns and primary girders provide additional lateral stability and general redundancy.

As passengers stream through the transit hub, they may be unaware of the feat of engineering that has brought them here.