

Exposed steel creates visual drama in a Miami mall expansion—and plays a pivotal role in the addition of a second level mid-construction.



Turnberry Associates

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AS BRICK-AND-MORTAR retail space continues to lose ground to online shopping, the pressure is on for retail projects that do move forward to make their spaces as attractive, diverse, and useful as possible.

A newly expanded Miami mall has done just that. Today, Aventura Mall is the third-largest shopping mall in the U.S. The mall has more than 2.7 million sq. ft of retail, dining, and recreational area, and also serves as a transportation hub for both Miami-Dade Transit and Broward County Transit services. Recently, the mall also underwent a three-story, 315,000-sq.-ft expansion.

So how did the mall reach its current, massive size? After considering initial site proposals, owner Turnberry Associates and developer Simon Property decided to expand into vacant land adjacent to the mall and challenged the design team of structural engineer DeSimone and architects Carlos Zapata and JPRA to conceive a monumental structure with soaring cantilevers, an ultra-modern façade, multiple glass skylights, and a giant window wall to promote the flow of natural light.

As retail development is exceptionally schedule-driven, leases are typically negotiated far in advance and involve strict deadlines for delivering tenant space and penalties for dates missed. That considered, structural steel was selected as the optimal framing material to achieve fast erection, the long span, and large cantilevers to meet the architectural vision.

Carlos Zapata, the project's design architect, conceived the expansion as a V-shaped building joined by an open "valley" space. Two wings emanate from this point, creating a gradually widening, open concourse with steel-supported skylights and clerestory windows that provide natural light. The two diverging branches are connected via multiple steel pedestrian bridges in spans of 60 ft to 80 ft. In addition to retail and dining components, a luxe concierge level welcomes VIP shoppers to the mall.

A 51-ft-tall by 80-ft-wide glass wall, supported by steel framing designated as architecturally exposed structural steel (AESS), encloses the northeast end of the concourse. AESS Category 2—feature elements viewed at a distance greater than 20 ft (6 m)—was specified for these components.

The glass wall incorporates a convex curve that blends into the curved roof, and a 34-ft section of the glass wall is bracketed off a bridge spanning across the concourse just inside the glass. This enabled a transparent ground-level entrance into the mall below a glass canopy that cantilevers outboard from the glass wall.

The design team maintained an extremely aggressive schedule to deliver an initial steel mill package (4,000 tons of structural steel were used in all) and drawings followed shortly after to allow detailing and foundation construction to begin. As the schedule eventually overlapped erection with design, the project team made budget allowances from the design development phase through



opposite page: The mall expansion features two diverging branches split by a “valley” over which span multiple steel pedestrian bridges—all topped by a nearly full building-length and gradually widening steel-framed skylight.

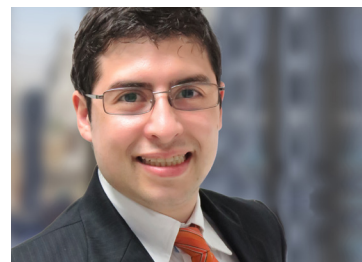
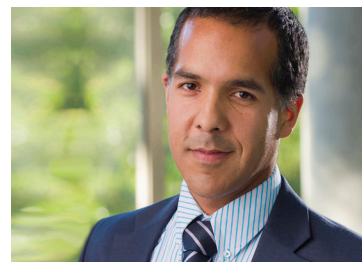
above: The valley is indicated by the skylight ridge in the center of the building.

construction planning. These allowances facilitated the development of miscellaneous steel details towards the end of the construction phase, which included perimeter steel supports for all of the façade elements.

Adding to the list of challenges, the owner required a majority of the existing mall to remain open during the construction phase. Temporary walls capable of withstanding tropical storm-force winds were installed to enable commencement of demolition and alterations necessary for the future connection. Columns that would have been in the middle of the connecting concourse had to be removed by demolishing and reframing the area. This phase of the project began with the construction of new access corridors and the erection of a new infill frame on the existing side of the mall to connect the two buildings. The steel framing consisted primarily of cantilever frames attached to the existing frames with moment connections and deep beams measuring W27 and larger. The beams joined the two main corridors and supported new escalators to create a seamless transition to the expansion.

Although foundations were already installed and structural steel fabricated, the owner requested an additional retail level on the east wing—while construction was ongoing. This new level would comprise a composite deck system with rigidly connected frames as the lateral system, and a design that was structurally identical to the levels below. However, due to the fact that the first level was already erected, columns on this existing level were reviewed to provide increased capacity for the gravity and lateral-load system moment frames. A portion of the erected columns required reinforcing to increase axial capacity. Roof framing that had already been fabricated was simply shifted one level higher, with the columns being reinforced with cover plates and the steel on the upper level being supported by full-penetration welding shafts to the lower sections.

The expansion includes special architectural features requiring detailed design and analysis, as well as a creative application of steel design principles. Some of these steel-framed features included an interior curved skylight over the main concourse; a monumental staircase that combined a concrete sculptural plinth with a cantilevered deck, extending 40 ft beyond its supports, to create an observation deck and porte cochère;



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and a pedestrian bridge, covered with an architectural canopy, spanning 80 ft to the adjacent parking garage.

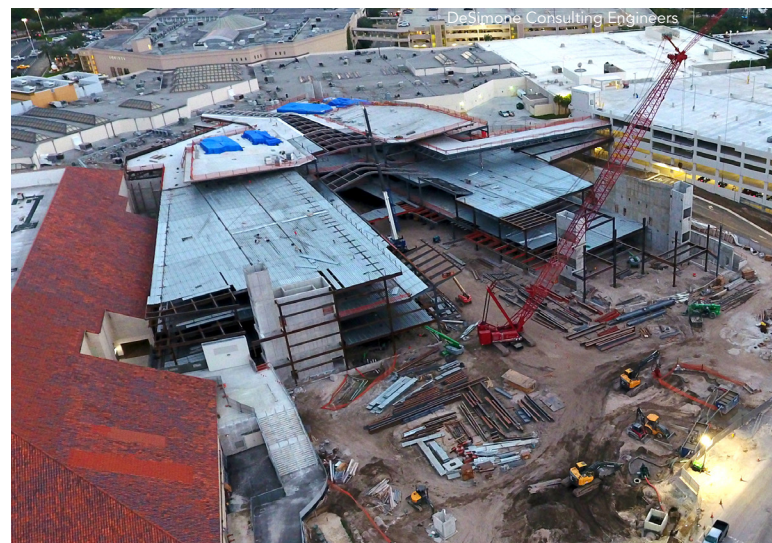
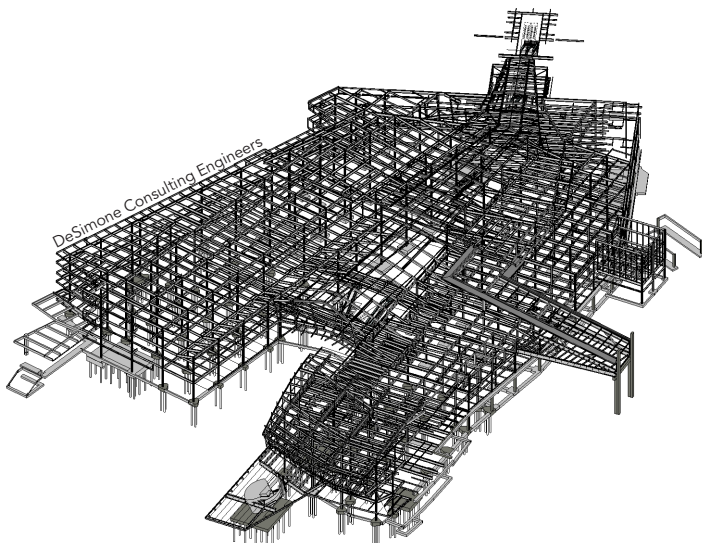
The steel-framed roof enclosure above the concierge area is complex in shape and features a double curvature interrupted in the middle by a depressed mechanical zone. The pronounced architectural curvature could not be achieved through commonly used hot-rolled shapes, so the solution was to assemble built-up beams using individual plates that were bent to achieve the desired curvature, then shop-welded to create the structural elements.

The typical deck system consists of wide-flange beams that support the concrete slab on steel deck. Headed shear studs welded through the metal deck to the beams create the composite beam action, resulting in better deflection control and more economical beams. The gravity load-resisting system uses standard composite beams connected to their supporting girders through shear connections, and the curved skylight structure is supported by a series of transfer elements and special connections that enable thermal expansion and contraction of the system spanning across the main



Harrison Boyce

A 51-ft-tall by 80-ft-wide glass wall, supported by steel framing designated as AECS, encloses the northeast end of the concourse. Built-up beams using individual plates form the roof elements.



The 315,000-sq.-ft expansion—shown as a structural model and under construction—connects the existing mall with a parking garage.

concourse. The lateral system used a combination of steel moment frames and concrete shear walls, and the lateral-resisting system elements were strategically located to accommodate large floor and roof openings, creating diaphragm discontinuities throughout the building.

A 3D modeling approach was crucial to the success of the project and allowed for a more detailed exchange of information between the architecture and engineering teams. The interface between the skylight and the deck levels consists of sloping frames that attach to the curved HSS members to form the skylight supporting frame. The nature of the architectural design was markedly intricate at this level, and the 3D models were instrumental in the development of a suitable framing system. This information also assisted in developing the supporting steel framing by tracking load paths and working out element connectivity based on the architectural proportions and spaces.

In the end, the expansion was erected in 40 weeks including the time required to provide the additional level mid-stream, and tenants moved in prior to the Thanksgiving shopping season, satisfying both ownership and retailers. ■

Owner

Turnberry Associates, Miami

General Contractor

Plaza Construction, Miami

Design Architect

Carlos Zapata Studio, New York

Architect of Record

JPra Architects, Farmington Hills, Mich.

Structural Engineer


DeSimone Consulting Engineers, New York

Connection Designer


Drucker Zajdel Structural Engineers, Inc., Chicago

Steel Team

Fabricator

Steel Fabricators, LLC, 
Fort Lauderdale, Fla.


Erectors

Steel Fabricators, LLC
Buckner Companies, Graham, N.C. 

Detailer

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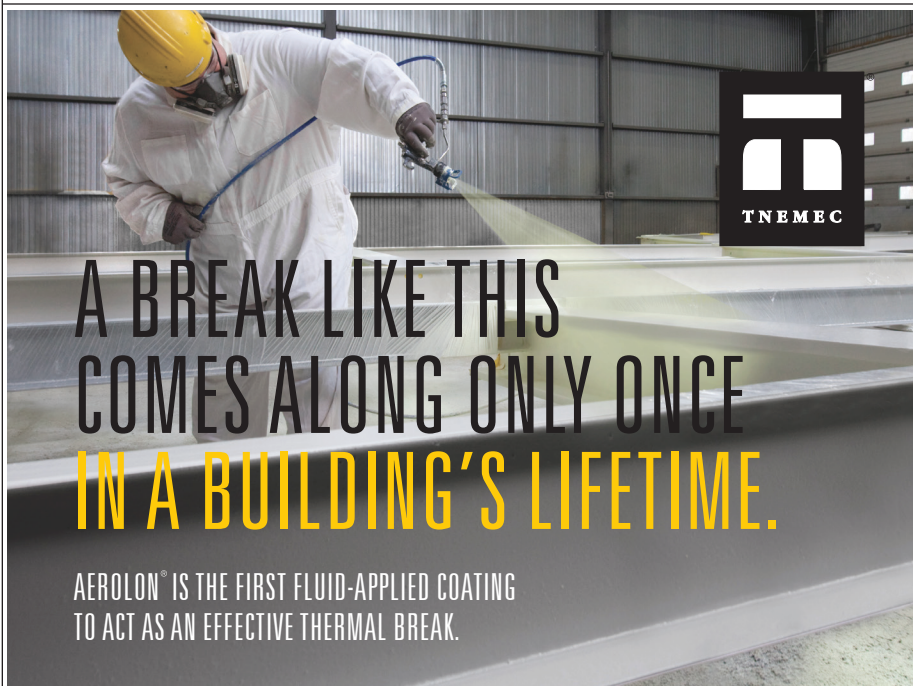
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