



Bitexco – Symbolizing Vietnam’s Global Emergence

An Iconically Shaped, Structurally Sophisticated and Sustainable Design

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Leslie E. Robertson Associates, RLLP was an Outstanding Award winner for the Bitexco Financial Tower project in the 2011 NCSEA Annual Excellence in Structural Engineering Awards Program (Category – International Structures over \$100M).

Located in Historic District 1 and the heart of Ho Chi Minh City’s Financial District, the 863-foot (263m; 68-story) Financial Tower rises as a Beacon towards the future of Vietnam. The tower uses as its reference the nationally symbolic Lotus flower to build upon Vietnam’s history, as well as to make a statement that Vietnam has arrived and is capable of competing in the global marketplace.

Developed in response to Ho Chi Minh City’s rapid population and business growth, the mixed use facility, which includes a high-rise office building, a five story retail podium, and four basement areas, eases the demand for commercial space.

Split-Level Basement & Donut

In Ho Chi Minh City, where the construction standard is two basement levels for major projects, Bitexco’s small site and tower height increased the requirement to four. Faced with an aggressive schedule, property constraints, and a high water table, the project team developed a split-four-level basement excavation method with a shallow diaphragm wall which located the top of the tower mat foundation at the second basement.

Because of poor soil conditions, closeness of surrounding buildings, and basement access needs, the structural engineers chose not to use standard temporary bracing practices of tiebacks and rakers when building the perimeter diaphragm wall. Instead, the team devised a partial top-down construction method where the ground floor perimeter slab (“donut”) stabilized the top of the diaphragm wall before basement excavation started. The decision permitted excavation of the tower mat foundation without temporary bracing. After superstructure construction, the tower mat then served as a bracing point for temporary supports for lower excavation of adjacent areas.

The estimated 123,680 ton (112.2 million kg) weight of Bitexco Financial Tower and poor soil conditions necessitated very deep foundations. Design needed as well to

address a soil-structure time analysis which predicted an approximately 100mm settlement. To compensate, a 13-foot (4m) thick bored pile supported mat distributes the tower loads from the walls of the narrow services core over the extent of the mat. At the tower, 5-foot (1.5m) diameter bored piles extend to a depth of between 262 to 295 feet (80 to 90m), while at the podium and underlying basements, 4-foot (1.2m) diameter bored piles go down as far as 207 feet (63m).

Despite the extra time required to install the deep foundations, the split-level basement and donut slab cut at least a year in excavation and construction time from the four basement design concept by enabling the tower construction to start prior to completion of all basement levels.

Helipad Test Assemblage

Supporting the helipad, which protrudes from the tower near the 55th floor, are a pair of 82-foot (25m) long tapered steel cantilever girders which span from the core walls to the perimeter tower columns, and extend outward to frame the platform. Perpendicularly oriented secondary structural steel beams cantilever beyond the primary girders to support the circular edge.

While the choice of steel produced a lighter structure and sped fabrication, construction of the huge cantilever at the given height presented challenges. To ensure that parts integrated cohesively prior to hoisting in the air, workers test assembled the helipad offsite.

Unconventional Outrigger Truss

The skyscraper-free views, ovo-tubular design, and high aspect ratio potentially create wind induced building sway problems for the Bitexco Tower. To minimize this possible motion, the structural engineering team developed an unconventional steel outrigger truss system. For wind load resistance, the structural design interconnects the out-rigger trusses and belt walls to the core walls and perimeter columns at Floors 29–30, and allows the outrigger and



Bitexco Financial Tower rises above Saigon River, Ho Chi Minh City, Vietnam. Courtesy of the Bitexco Group.

belt wall system to function with the concrete core walls. The outrigger trusses and belt walls stabilize the core by resisting a portion of the overturning moments associated with wind-induced east-west movements.

Within the outrigger system, two of the four sets of double-story trusses align with the two primary core cross walls and the other two trusses align with the fire stair walls, while connections of the outrigger trusses to the cross walls effectively transfer forces. Four one-story-tall belt walls, with two on each side of the tower, interconnect pairs of perimeter columns to each outrigger truss.

Conclusion

An iconic landmark, Bitexco Financial Tower provides a model for Vietnam’s global emergence through a sophisticated and sustainable design. Innovative approaches to the foundation’s excavation, helipad assemblage, and the outrigger truss system secured completion by Vietnam’s 400th anniversary. ■

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