"Structural Design of the World’s Tallest Building: The Burj Dubai Tower"

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The Burj Dubai Tower, when completed, will be the world’s tallest structure. The superstructure is currently under construction and as of the start of 2007 has reached near 100 stories. The final height of the building is a “well-guarded secret.” The height of the multi-use skyscraper will “comfortably” exceed the current record holder of 509 meter-tall (1,671 feet) Taipei 101. The 280,000m2 reinforced concrete multi-use Tower is utilized for Retail, a Giorgio Armani Hotel, Residential, and Office. The goal of the Burj Dubai Tower is not simply to be the world’s highest building; it’s to embody the world’s highest aspirations.

Designers purposely shaped the structural concrete Burj Dubai—Y-shape in plan—to reduce the wind forces on the tower, as well as to keep the structure simple and foster constructability. The structural system can be described a “buttressed” core. Each wing, with its own high performance concrete core and perimeter columns, buttresses the others via a six-sided central core, or hexagonal hub. The result is a tower that is extremely stiff torsionally. SOM applied a rigorous geometry to the tower that aligned all the common central core and column elements to form a building.

Each tier of the building steps back in a spiral stepping pattern up the building. The setbacks are organized with the Tower’s grid, such that the building stepping is accomplished by aligning columns above with walls below to provide a smooth load path. This allows the construction to proceed without the normal delays associated with column transfers.

The setbacks are organized such that the Tower’s width to change at each setback. The advantage of the stepping and shaping is to “confuse the wind.” The wind vortexes never get organized because at each new tier the wind encounters a different building shape.
The 280,000m² (3,000,000ft²) Tower and 185,000m² (2,000,000 ft²) Podium structures are currently under construction and the project is scheduled for topping out in 2008. The Burj Dubai, currently the world’s tallest building, is the centerpiece of a large scale mixed use development comprised of residential, commercial, hotel, entertainment, shopping and leisure outlets with open green spaces, water features, pedestrian boulevards, a shopping mall, and a tourist-oriented old town.

The design for the 270,000m² tower combines historical and cultural influences with cutting edge technology to achieve a high-performance building that, which will set the new standard for development in the Middle East and become the model for the future of Dubai.

When designing the Burj Dubai, the design team looked to the sky for sustainable elements. In the extreme hot and humid climate of Dubai, the temperature between the ground (46.1°C or 115°F) and the top of the building (38°C or 100°F) can vary up to 8°C (or 15°F). Satellite data was used to predict the humidity drop with altitude (up to 30 percent reduction in humidity between the top and bottom of the building), and analysis was performed to study the air density drop up the building (up to 10 percent). SOM’s “sky sourced” sustainability innovations will result in substantial energy savings.

The Burj Dubai also has one of the largest condensate recovery systems in the world, capturing up to fourteen Olympic-size swimming pools of water per year, and one of the highest chilled water pressures ever used in a building to maximize efficiency. The tower is one of the first to utilize an active stack effect control in a super tall building to minimize energy loss.

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