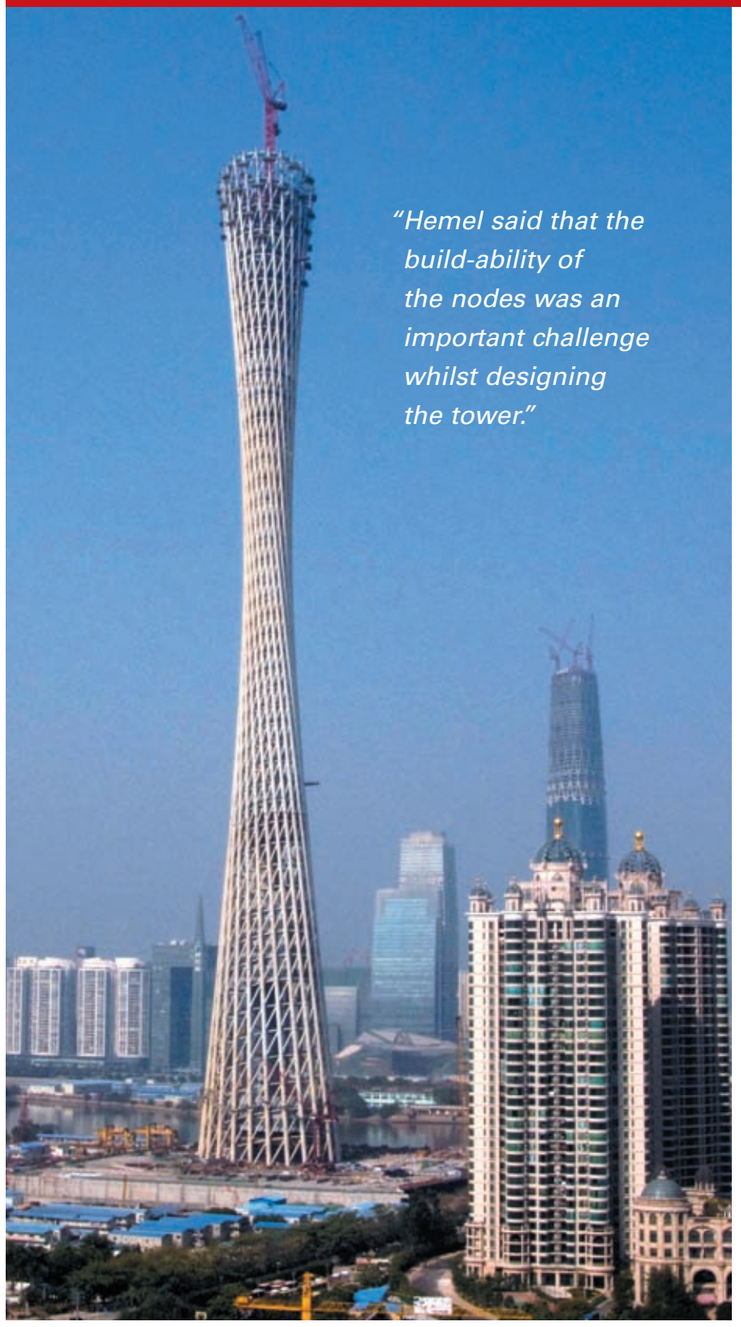
Svelte tower poses new twist on tall design

Guangzhou TV and Sightseeing Tower, China



"Hemel said that the build-ability of the nodes was an important challenge whilst designing the tower."

By ALAN MARSHALL and MARGRIT COLENBRANDER

A prominent architect and structural engineers have collaborated closely from the ground up to develop an unusually feminine-inspired design for a skyscraper destined to be one of the tallest buildings on Earth, the 37 storey Guangzhou TV and Sightseeing Tower in China.

Information Based Architecture (IBA) and Arup won the commission for the design of the new tower for the city which will host the 2010 Asian Games.

The development encompasses the tower destined to reach 610 metres high, a 17.9-ha park at its base and the masterplan for the surrounding 56.6-ha area which includes an elevated plaza, pagoda-park, retail facilities, offices, television centre and hotel.

Director of IBA, architect **Mark Hemel** said the hour-glass figure of the tower is not only a structural form but is also driven by aesthetic, architectural and environmental considerations.

"Whereas most skyscrapers bear 'male' features being introvert, strong, straight, rectangular and based on repetition, we wanted to create a 'female' tower being complex, transparent, curvy and gracious that earned it the nickname, 'super-model'," he said.

"We designed a tall twisted, tapering tube. The form, volume and structure are generated by two ellipses, one at foundation level and the other at an imaginary horizontal plane just above 450 metres. The tightening caused by the rotation between the two ellipses forms a 'waist' and a densification of material.

"This means that the lattice structure, which at the bottom of the tower is porous and spacious, becomes denser at waist level. The waist itself becomes tight. Further up the tower the lattice opens again, accentuated there by the tapering of the structural column-tubes."

All infrastructural connections like metro and bus stations and a pedestrian link to the northern embankment of the river are underground.

"Spatially the tower reads like a series of mini-buildings hung within the superstructure, with 'mega spaces' in between. These mega-spaces in between the mini-buildings are in fact floating gardens each varying in atmosphere; transparent, light and open at the base, and more closed and shaded at the waist of the tower," Mr Hemel said.

The design has undergone wind tunnel, fire and load tests and performance-based approaches have been adopted to satisfy local regulations on planning, fire escape and structural design issues.

The core of the television tower consists of a concrete elliptical shaft with a short and long diameter of 15.6m and 18.6m respectively.

The nodes and tubes of the steel web that give the tower its characterising profile were fully prefabricated and delivered by truck to the site from Shanghai. The elements are first connected by bolts and the bolt connections were burnt off only after the tubes all around were welded together.

The columns were lined out and filled with concrete for stability and fire-proofing after the first six rings and all the matching columns and tubes were constructed.

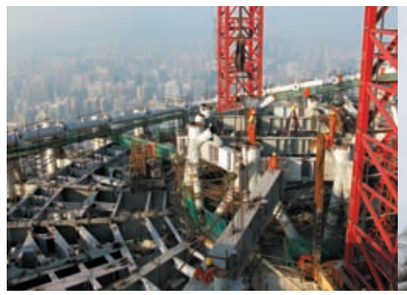
Hemel said that the buildability of the nodes was an important challenge whilst designing the tower.

"Although none of the 1100 steel nodes are identical, we still succeeded in creating one single type of node," he said.

"The rings are placed on the far inside of the columns so that they miss each other spatially and are connected off-centre. This inside view is dominated by the rings while the view from the outside is dominated by the sloping columns.

"All rings are placed under an angle of 15 degrees so that both an opening is created for the entrance at the base of the tower as well as a sloping deck at the top of the building, offering magnificent views over the city."

The columns are each two metres in diameter at the bottom of the tower, constructed of 50mm thick plated steel that is bent fully round in 3.7 metre wide bands welded together. At the top of the tower the column diameter is reduced to 1100mm with a plate thickness of 30mm.



While building, the contractor initially worked with five cranes. But from 100 metres upwards, the three cranes positioned outside of the lattice-structure were taken down and they continued with only two cranes until the structure and core were completed.

The antenna mast was prefabricated in parts that were lifted to the platform and then put together. The upper 80 metre section of the mast was built inside the wider and lower 80 metre part of the mast. The upper part of the mast was jacked up subsequently over the course of two weeks to reach its final position. There the two parts were welded together to complete the 160 metre high mast.

The steel structure of the main building was completed in late 2008 with the mast finished on 6 May with a top-off ceremony. The tower is due for completion by year's end to be fully operational for the 2010 Asian Games.

For more information, please visit: http://www.iba-bv.com

Project Team

Architect: Information Based Architecture (Mark Hemel and Barbara Kuit)

Structural Engineering: Ove Arup & Partners Hong Kong

Local Design Institute: Guangzhou Design Institute

Client: Guangzhou Construction Investment & Development Co. and Guangzhou Xin Xin TV and Sightseeing Co.

* Photos courtesy of Information Based Architecture.