



CTBUH Journal

Tall buildings: design, construction and operation | Summer 2007

Executive Director's message

Energy efficiency on
a global scale

Sustainable design in
high-rise residential

Welcome



Welcome to the *CTBUH Journal*, the publication for the Council on Tall Buildings and Urban Habitat.

Our summer lead is a message from Antony Wood, CTBUH Executive Director. Our focus is a discussion led by Peter Warburton of Arup and myself on energy efficient buildings, on a global scale. We also explore sustainable residential high-rise design, and look at the sustainable design behind some of the most striking new tall buildings. We top out this issue with profiles and members listings. **Zak Kostura, Editor**

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CTBUH news and events

Council News

Membership of the Council continues to grow rapidly and we have a committed and enthusiastic team working for the Council, both volunteers and staff. We are well on track to implement our 5-year plan: our Steering Group has been revitalized, our Country leaders are growing, we have started a Tall Building Resources Center and we have launched a new CTBUH website, with many hundreds of technical papers and videos.

Twenty-seven representatives from 5 countries attended our International Height Meeting and are now updating our Height Criteria for tall buildings. In response to demand, we also inaugurated two new awards in 2007, the 'Best Tall Building' award and 'Best Sustainable Tall Building' award. In addition we are collaborating with John Wiley & Sons on an annual CTBUH issue of, "The Structural Design of Tall and Special Buildings", that, despite its title will be a multidisciplinary peer-reviewed journal.

With great support from Dubai, we are very pleased with our plans for the CTBUH 8th World Congress that will be held in Dubai,



International Height Meeting in progress

March 3rd-5th, 2008. We have received many proposals and commitments for some great papers and the "Call for Papers" is open until 30th of September 2007. For more on these and other initiatives, visit our website at www.ctbuh.org.

It is interesting that the more we do, the more we find that needs to be done, and we will continue to expand what we do, with your help and support.

Working Groups

Despite being in the 21st Century, there are still many aspects of tall building design and construction that are based more on tradition rather than on science and knowledge. Not only does tradition influence construction techniques and details but it can affect a whole country's approach to design and construction. For instance we know that in some parts of the world, design codes for tall buildings are unsafe and ineffective, while in others they are overly conservative and redundant. There is much for the Council to do, to collect and share knowledge.

It is interesting then that the sustainable design movement has been embraced by almost all countries throughout the world, in a relatively short time frame. It is perhaps because we are at the very first easy stages of implementing sustainability that we have this consensus. But we have a long way to go

and we need to keep moving. From my perspective, we will enter the next phase of sustainability only when building professionals can collect data on what energy buildings really use.

However there is clearly an opportunity for tall buildings to take a lead role in the sustainability movement and this is being pushed by some cities and states. Our Sustainable Working Group, that has been assembled by Sadhu Johnson of the City of Chicago and Antony Wood are working with the World Green Building Council to do just that.

As mentioned our 2008 Congress will focus heavily on sustainability. We will be buying carbon offsets, to compensate for the travel to Dubai and I hope to see many of you there.

The Journal

Congratulations to Zak and his team for putting together this excellent new format for the Council's quarterly Journal. It is a great improvement. This Journal gives our membership a high quality platform to show off their buildings, to publish their opinions and to write technical articles. I hope that everyone will take full advantage of it.

To maintain a high quality Journal we need well-written articles and great quality images. We are developing our editorial calendar and are particularly keen to encourage articles that discuss topical issues and educate our readers; like this month's article on post-occupancy monitoring of energy use in tall buildings, which is a subject that all building professionals should care about.

Only members are entitled to publish in the Journal and Antony Wood heads its editorial board. We will respond to any Journal papers or synopses within two weeks of receipt, and if an article is accepted for publication we will inform you of the proposed publishing date. The papers will also be published on our web site a few months after the hard copy is distributed.



CTBUH Chairman, David Scott

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Executive Director's message

On 1 October 2006, Antony Wood, a UK-registered architect, took up the role of Executive Director of the Council on Tall Buildings and Urban Habitat. This article explores his background, and hopes and ambitions for the Council.

Having been involved with the Council on Tall Buildings and Urban Habitat for several years in a voluntary capacity, as Vice-Chairman for Research and country leader for the UK, it was with great excitement that my family and I made the move from the UK to Chicago last fall. My appointment as Executive Director marks a new phase of growth and increased activity for the Council, under the high-energy leadership of Chairman David Scott and building on the platform of stability and growth created by the immediate past-Chairman Ron Klemencic, without which none of the current successes of the Council would be possible.

My own background in tall buildings – if you discount a childhood passion for skyscrapers – began as a result of a one-way flight ticket from the UK to Hong Kong and a keen desire to see the world at the end of my undergraduate degree in architecture. The year was 1991 and, six years before the Hong Kong handover back to China and during general economic uncertainty in the colony, finding a job for a fresh graduate with little professional experience proved to be rather difficult. Perseverance (and more than a little luck!) saw eventual success with the in-house architectural consultancy of a Hong Kong-based, international developer – Wisepower Consultants (later Multitect Consultants). I was given a pencil and a drawing board at the end of the interview and the next day I was whisked off to Bangkok. It was the start of a seven-year Asian adventure which was to see me working in Hong Kong, Thailand, Indonesia and Malaysia, as well as a period of advanced study in Australia.

The first project in Bangkok – SV City – was a speculative high-rise 'mini-city' for the Thai conglomerate Sahaviriya, located on Rama III Road fronting the Chao Phraya river. Comprising three office towers and eight residential towers ranging from 45 to 60 stories in height, set on a podium of retail and car parking (see Figure 1), this project set an oft-repeated pattern for my career through being thrown in at the deep end and given a level of responsibility perhaps beyond my years.

One of only two westerners leading the design team of largely Thai and Hong Kong draftsmen, we had an eight-month period to progress the design from conceptual through to full working drawings – with the inevitable daily mega-changes in brief, programme (and, sometimes, site!) to contend with that anyone



Antony Wood



fig 1. SV City, Bangkok, Thailand.



fig 2. Kuningan Persada, Jakarta, Indonesia



fig 3. KL Central International Railway Terminal, Kuala Lumpur, Malaysia

working in south-east Asia during that period will be familiar with. Still, early 1990's Bangkok was an incredible place to cut one's professional teeth and it was a delight to return to the city three short years later and see the whole project built.

After a spell of post-graduate architectural study back in the UK and Melbourne, Australia, I decided to do it all again and another one-way ticket out to Hong Kong saw me delivered into the professional arms of Liang Peddle Thorp architects (now the multi-national consultancy Aedas). My prior high rise design experience saw me, once again, whisked off to another regional office – this time Jakarta – where a very happy year was spent on the design of the Kuningan Persada mini-city project (see Figure 2). Now 1997, the bells of economic crisis in the region tolled however and, as speculative projects hit the trashcan at an alarming rate throughout southeast Asia, LPT Architects pulled me on to the KL Central International Railway Terminal Project in Kuala Lumpur, in design-and-build consortium with the developer Bouygues. As project architect for the detailed design and construction of the facades of this mega-project, an extremely useful 18 months on-site technical experience to complement the earlier design exposure was gleaned (see Figure 3).

At the end of the nineties, the female architect I had met in Jakarta who would soon become my wife, and I, returned to the UK, first to London and then to Manchester where, as an Associate Director for the architectural practice BDG McColl, I headed the Manchester office. Despite the excellent jobs and experiences I'd had to date however, a slight disenchantment with aspects of private practice led me to academia and, in 2001, I became a Lecturer in Architecture at the University of Nottingham.

It seemed natural for me to concentrate my teaching and research as an academic in the field which I new best from practice – tall buildings – a decision only bolstered by the events of 9/11 later that year and the growing reappraisal of the typology that grew out of the disaster. In conjunction with external partners such as the WSP Group, Canary Wharf and the Fire Engineering Group at the University of Greenwich, I began research into alternative forms of tall building evacuation (predominantly the potential of skybridges) and, at the same time, focused several architectural student design studios on the design of tall buildings. Much of this tall building teaching and research collaborative work was formalized in the founding of the Tall Building Teaching and Research Group (www.tallbuildingstarg.com) which I have led since 2004.

The Future of Tall Building design?

Despite my great enthusiasm generally for tall buildings, I believe there are very few high-rise buildings which are really excellent pieces of design. Tall Building designs historically seem to have followed one of two approaches (i) the commercial, vertical-extrusion-of-an-efficient-plan rectilinear box model, or (ii) the tall-building-as-piece-of-iconic-sculpture model. What concerns me with both these approaches is that the physical relationship between the building and the city is a purely visual one and, as such, the models are transportable around the world without regard for the specifics of place. As someone who has worked and traveled across all seven continents, I believe we need to celebrate and attenuate the cultural differences between places and I feel that the tall building has contributed massively to the homogenization of urban places across the globe. Now cities are defined by their unique set of high-rise icons, but the architectural language is a common one and typically bears no relation to often thousands of years of vernacular tradition. ➤

Sustainable and Tall

In 2003, a groundbreaking study on sustainable design with reference to tall buildings was concluded by the Faculty of Architecture and Urbanism at the University of São Paulo, Brazil. It began as a series of case studies on existing buildings deemed sustainable by current metrics. The project sought to examine the definition of a sustainable tall building and its attributes. The findings were presented in the Ph.D. thesis *The Sustainability of the Tall Building: a Discussion about the Urban Insertion of Tall Buildings*.

The study is a broad field-work of cases from North America, Europe and São Paulo itself, along with interviews with designers and other specialists in the topic. The paper begins with what the definition of the sustainable tall building is, covering urban and architectural aspects to environmental impacts.

Secondly, it highlights a new generation of tall buildings towards environmental goals with an emphasis on the European approach. During the last decade there has been a parallel development of iconic tall office buildings in São Paulo, which has been strongly influenced by the North-American experience. This search for the sustainable tall building has shown that there are multiple architectural, urbanistic and engineering possibilities, indicating that there is not one unique or universal model.

Finally; current views need to be broadened and more contextualized. Developers, architects and engineers from around the world should look for the environmental attributes of the local architecture in which they are designing and incorporate appropriate contemporary technological solutions into their building designs.

Defining the sustainable tall building

In architectural terms, the idea of the tall building has always been related to the notion of slenderness of the building form. Although this is a subjective aesthetic concept it is commonly cited among specialists as a major factor to define and perceive tallness. For urban and architectural purposes it is broadly recognized by engineers, architects and



fig. 1

planners that there should be a contextual approach, in which the notion of tallness is relative to its surroundings. Therefore, the notion of the tall building is relative to the heights of the surrounding urban fabric and is an architectural expression. This is an important topic of urban design and planning.

A sustainable tall building should have a comprehensive proposal for its environmental and urban impact. Along with global sustainability goals, the proposal should encompass architectural, engineering, environmental and urban issues. For the existing urban environment, the architectural design of the tall building should follow certain guidelines:

- Be part of a site's masterplan to reorganize and intensify urban density. If within an existing urban environment of high density, support the existing infrastructure, like major transportation nodes;
- Offer mixed-use functions or be within a mixed-use part of the city;
- Offer public spaces. As a minimum, the ground floor should be dedicated to the public and possibly include green areas;
- Have form and height influenced by the local existing urban morphology;
- Cast shadows that do not compromise the quality of open public environments (the

duration of the shadow over a certain spot is more important than the size of shadow) and;

- Prevent pedestrians' discomfort due to undesirable wind flows around buildings. The tall building should contribute positively to the air flows around buildings.

In regards to internal environments and management of resources, the basic guidelines are:

- Designed for durability and flexibility;
- Present alternatives to reduce the building's internal heat gains;
- Maximise passive strategies for cooling and/or heating of the building's internal environments;
- Maximise daylight penetration without heat gain loads. In the specific case of offices, satisfactory daylighting levels in working areas are desirable for most of the annual daytime hours (based on work-specific functions). Integrate this daylighting with the artificial lighting systems;
- Recycle grey water and collect rain water;
- Separate solid waste into different categories and;
- Operate towards zero CO² emissions in regards to heating, cooling, lighting and other mechanical and electrical systems.

The above definition of the sustainable tall building does not imply an autonomous building for energy and water supplies or in waste and sewage treatment. The building should contribute to the local social structure and is not autonomous in its variety of functions. On the contrary, sustainability as defined is the relationships of interdependence between the city and the tall building. Urban infrastructure has to be planned to accommodate increases in density, due to the insertion of the tall building or a cluster of buildings into the situation. Interestingly, the definition given for the sustainable tall building brings the idea of making the sustainable tall building less tall than the impressive heights seen in historical precedents (and still being targeted today), in order to reach a compromise between the economics and the urban and environmental impacts.

With regards to image, height alone is not a dominant factor for the iconic sustainable tall building. Other variables have gained importance in design, such as:

- Flexibility of the floorplans;
- Internal environmental quality;
- Energy efficiency and;
- Urban location.

The aggregate value of these qualities is important for an iconic contemporary tall building.

Lastly, it is important that a tall building successfully contribute to the sustainable urban environment. It is fundamental that the existing urban infrastructure is in place, in order to provide for a public transportation network, the generation of clean energy, waste recycling, provisions for green public areas, and mixed-use neighborhoods. As a result, the sustainable tall building will interact with the multiple layers of the city, operating to sustain the social, economic and environmental aspects of the existing neighborhood.

A new generation of tall buildings towards environmental goals

London, Frankfurt, Rotterdam and other European cities have pro-active plans towards the development of new tall buildings, aiming to benefit from the building's urban renovation and economic growth. However, a clear set of urban, economic, social and environmental design criteria is required. A number of European proposals for tall buildings in the last two decades have brought about the theme of a more environmental and contextual approach. Reviews are in terms of infrastructure, economics, social, environmental and morphological matters. Besides the environmental performance, the impact of the tall building upon the urban morphology and skyline is a special concern. At the same time, the traditional design of the tall building in the United States has also been improving, in regards to higher energy efficiency technologies for the internal environment.

It has been acknowledged by design experts that sustainable tall buildings have evolved

faster in Europe than in the United States. In architectural terms, the European approach has been gradually incorporating more detailed façades, passive strategies and means of natural ventilation. One aspect of environmental design and the buildings' energy performance is common to both scenarios: the tall building designed to improve the quality of the internal environment and to reduce the energy consumption is confronted by the investors' perspective of higher initial costs. The innovative character of the building's design could change the culture of the design process, including the assessment of the building's performance, economic risks, and environmental risks. Some architectural firms, in close collaboration with leading engineers, have developed proposals claiming to be environmentally friendly models of a new generation of tall buildings. An innovative group of tall buildings proposed for European cities since the beginning of the 1990s has been revealed regarding energy and environmental issues, in which the architectural parameters of height, form and size are fundamental for the building's performance to meet sustainability goals. Such design parameters are related to the environmental and physical characteristics of a specific urban location. Design requirements for passive strategies, such as floorplans that utilize daylighting and natural ventilation, along with the design of façades influenced by local climate requirements and the building's function, are also determining factors for the aesthetics of the new models.

The assessment of tall office buildings from Frankfurt, London, New York and Sao Paulo (the city of tall buildings in South America) has shown that architectural and technological features, justified by environmental parameters, produce comfort and productivity for the occupants along with the building's energy efficiency. These case-studies have become international references for the sustainable tall building, bringing about a degree of design and technological innovation within their respective local urban contexts (GONÇALVES, 2003).

Looking at the impact on the city's transportation network (a subject of great



fig. 2

importance when discussing tall buildings and urban sustainability), it is interesting to note that the buildings located in London, Frankfurt and New York, offer less car space than officially established by their respective public zoning. Such initiative has great social value for both urban life and local environments. The opposite is observed in the tall buildings in São Paulo, revealing the city's dependence on cars. This aggravates the precarious condition of public transport.

Among the European case studies, it is worth highlighting the Commerzbank HQ (258m, 58 floors) in Frankfurt, from 1998, known in the specialized literature as the first built "green skyscraper" (see fig.1). This title comes mainly from its strategies for environmental control and energy efficiency in the use of natural ventilation for a tall building. The building in operation has actually performed better than the predictions, naturally ventilated 80 to 85% of the year, surpassing the 60% estimate of the design process. The Swiss Re HQ (180m, 41 floors) in London, from 2004, is another iconic example of the office tower designed towards environmental performance. The architectural and technical features are:

- Unusual curved shape based on different sizes of circular floor-plans;
- The double skin façade; ➤



CTBUH 2008

8th World Congress

March 3-5, 2008
Grand Hyatt Hotel
Dubai, UAE

Tall and green: Typology for a Sustainable Urban Future

speakers include:

Al Gore (invited)
Former Vice President, USA

Mayor Richard Daley
(invited)
City of Chicago

Mayor Ken Livingstone
(invited)
London

Ken Yeang
Llewelyn Davies Yeang

Bill Baker
Skidmore Owings and Merrill

Werner Sobek
Werner Sobek

Guy Battle
Battle McCarthy

Alastair Guthrie
Arup

Christie Whitman
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Hani Rashid
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Leslie E. Robertson Associates

and more!

For more information and registration visit
the congress website www.ctbuh.org