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Tall buildings: design, construction and operation | 2012 Issue II

Capital Gate, Abu Dhabi

Securing Iconic Structures

Environmental Performance of the TTDI

Developing Rotterdam's Skyline

Talking Tall: The Skyscraper Index

Debating Tall: Is UNESCO Going Too Far?

Tall Buildings in Numbers: Occupiable Telecommunication & Observation Towers

Council on Tall Buildings and Urban Habitat

This Issue

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Back Cover: Capital Gate – the "Splash" © ADNEC

How are supermarkets and tall buildings alike?

I love supermarkets. They provide good quality food and other stuff at competitive prices, in well laid-out stores. And one supermarket chain's reward system means I get to drive a fast car around a race track once a year, with my petrol-head father-in-law.

At the same time, I hate supermarkets. They squeeze their suppliers and drag their immense corporate shadows across the land in the search of yet more space. One giant chain in particular has drawn howls of protest by planning to open a store in my little village south of London, next door to an ancient church on an already dangerous traffic junction.

And so it is with tall buildings: they tend to polarize opinion. They are the extroverts of the property world and therefore magnets for fierce comment, for and against. Like supermarkets, they are also seen as symbols of capitalism and commercial intemperance. With tall buildings, people tend to fall in either the pro or against camps.

These extreme positions characterized the debate about tall buildings in London a decade ago, and seem to be resurfacing – not only in the capital but around the country, too. The emotional dispute over UNESCO's role in planning projects in the UK is laid out in Debating Tall, on page 5.

A recent article in The Independent newspaper, entitled "In the Shadow of The Shard," reported on the growing opposition to "the tall, ostentatious, the showy, and the iconic," from London to Glasgow. Interestingly, it did not cite any criticism of The Shard, which nine years ago was described, now infamously, by English Heritage as "a spike through the heart of historic London." Now it is almost universally loved – as is 30 St. Mary Axe (the "Gherkin"), which at the time of its conception caused quite a stir, not least by UNESCO, which worried about its impact on the Tower of London.

As someone with a love of the subject, my gut reaction to such negative stories is a protective one. How dare they criticize towers?! Yet that is wrong. While I might not agree with much of the content, there is no doubt that there are valid concerns to be addressed. As William Murray is quoted as saying, "We mustn't assume that everything tall, new, and shiny is good."

This, I think, is a serious point for the CTBUH, and is something that occurred to me while I was in Chicago for the Board of Trustees annual meeting in March, during discussions on the Council's mission and objectives. We have to take care not to support tall buildings per se, or be seen as doing so. Instead, we must ensure that we promote good design, innovative thinking and collaboration. Spirited debate can lead to proper consideration of all aspects of high-rise development, in the pursuit of sustainable cities.

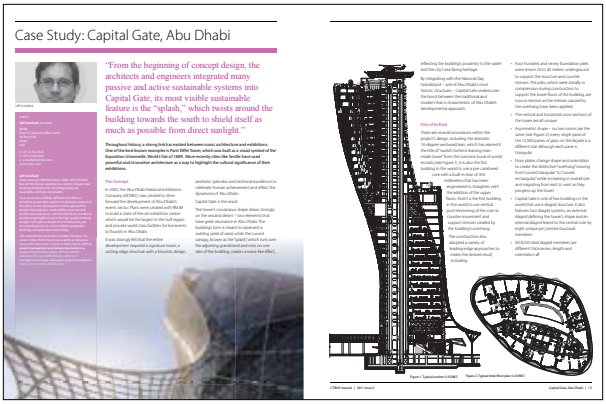
Good tall buildings encompass the dramatic and shapely as well as the rational and functional. And so do poor tall buildings. We should celebrate the extraordinary, but also celebrate the sometimes under-appreciated creativity required to produce a seemingly more straightforward form, that generates value in different ways. This is something that the Council has certainly accomplished over the years, and we should all attempt to achieve a balanced perspective, whatever our field.

I didn't think I was a NIMBY, but I am – we all are. A certain supermarket giant has made me a little more aware that passion and objectivity can be engaged in a difficult battle

Cheers,

Steve Watts, *CTBUH Trustee*

Inside



"Although commonly classified as a typology of high-energy demand, tall buildings can be beneficial in hot, humid climates. Considering both urban and building scales, the typology enhances the exposure of the built form to wind flow, generates more wind at the ground level and provides desirable shadows upon the immediate surroundings."

Suraksha Bhatla & Joanna Gonçalves, page 24

Debating Tall: Is UNESCO Going Too Far?

Controversy has erupted over development proposals in London and Liverpool in the UK, which UNESCO says will damage views of World Heritage sites. Critics counter that UNESCO is over-stepping its mandate by inserting itself into the planning process and threatening to revoke world heritage status. The question for this edition of Debating Tall: Is UNESCO going too far?

YES

Paul Finch
Editorial director of Architectural Review and Architects' Journal; deputy chair of the UK Design Council

Impertinent claims to authority by UNESCO, the unelected Paris-based bureaucracy, are resulting in Gauleiter instructions to cities as to what they should do with their built history. The latest example is London, where UNESCO is throwing its weight about in relation to the "world heritage site" of Parliament Square, location for the Houses of Parliament and Big Ben.

UNESCO is "warning" Westminster Council and the UK government that proposals in the Waterloo area, on the other side of the River Thames, will put the status of the world heritage site at risk. This is because views of planned buildings by David Chipperfield, among others, would allegedly ruin the experience of the heritage site.

Why is UNESCO concerning itself with developments in a highly regulated western city? The answer: developing countries with real world monuments, like Egypt and its pyramids, became fed up with demands UNESCO kept making on them. How come UNESCO never made similar demands of developed countries?

UNESCO began looking for cities in developing countries where they could interfere. One consequence of this was a government decision to hold a public inquiry into Rafael Vinoly's "Walkie-talkie" tower in the City of London. It had been given planning permission, but then entered UNESCO, with some menacing noises about the Tower of London losing its world heritage site designation.

The threat to remove world heritage site status from the Tower of London had occurred earlier in respect of Renzo Piano's Shard scheme at London Bridge. This can be seen from the Tower, though it is not directly opposite and is also on the other side of the Thames. The inquiry inspector had no problem about view impact and recommended approval for the Shard, which is now nearing completion.

Earlier, at a public inquiry into the Heron Tower office building in the City of London, the inspector recommended allowing the development, also nearing completion. He said that just because you could see a building from a conservation area did not mean that the area had been ruined.

We need to give a robust response to UNESCO. That might be along the lines of: we have looked after our heritage for centuries without you telling us what to do or how to do it.

To use an old-fashioned London phrase: why don't you stick it up your jumper? And remember Waterloo!

Editor's note: *This article is adapted by the author from an earlier version which appeared in the Architects' Journal.*

London Skyline © CTBUH

NO

Marie-Noël Tournoux and Patricia Alberth
UNESCO World Heritage Centre

UNESCO is concerned by the multitude of historic cities and World Heritage sites facing difficulties in reconciling conservation and socio-economic development. The challenge is to promote heritage-led planning policies that consider the significance of heritage, and artistic and architectural achievements.

We are witness to a living paradox. On the one hand, heritage sites and historic cities experience increasing economic success and are promoted, or marketed as never before. On the other hand, the actual values and fabric of heritage are frequently neglected, insufficiently maintained, destroyed or "Disneyfied" in the name of progress and modernization. What is often forgotten is that an integrated approach to heritage-led regeneration delivers measurable economic, social, cultural and environmental benefits. Examples from cities such as Paris, Rome and Edinburgh demonstrate why heritage should not be seen as a marginal issue, but as inherently linked to economic development, social cohesion and identity.

World Heritage is not just about preserving national monuments or natural wonders. It is about reclaiming values. Compare today's trendy Marais Quarter of Paris to the derelict slum of the '50s. Today the area thrives, the skyline is preserved and companies compete to invest in listed monuments with heavy heritage preservation constraints.

The heritage quality is now an important part of the real estate proposition in Paris. It has developed new areas mixing houses and office space, attracting architects and developers from around the world. Pritzker Prize winners have created daring designs which are compatible with the historic environment. The issue is adapting projects to context, not constraints

Unfortunately, the pride and visibility gained by the listing of a specific site does not always become a lever for development. In some cases it is perceived as a handicap. However, why should respecting height limits, visual integrity, and contextual adaptation based on the assessment of a site's value be less feasible than observing fire security restraints or climate protection measures?

The last 30 years have witnessed rapid changes in global population growth and migration, increasing pressures on land use and energy consumption. Today, with more than three billion individuals living in cities, the challenge is developing a system to manage change and integrate cultural assets in planning to understand cities in their complexity as historic urban landscapes. Heritage should be considered as a link to develop change in a sustainable manner. Conservation addresses the past and the future at the same time. It is an intellectual process of mediation between different paradigms.

More information on UNESCO's recommendations on the historic urban landscape can be found at: ***http://whc.unesco.org/en/activities/638/***

Global News

Visit the daily-updated online resource for all the latest news on tall buildings, urban development and sustainable construction from around the world at: ***http://news.ctbuh.org***

Europe

Interesting tall buildings are popping up in unusual spots around Europe.

In **Venice**, officials have approved plans for a 60-story tower designed and funded by fashion guru Pierre Cardin, hoping to create a new icon for the icon-laden city. Venice is literally sinking into the sea under the weight of its classic buildings. However, civic leaders feel the outlying areas could use an upgrade.

Mr. Cardin's project, dubbed **Palais Lumiere,** will be the centerpiece of a new suburb on reclaimed land north of the city. At 244 meters, it would be the tallest building in Italy, by far, in a country that has steadfastly resisted the tall building boom (the current tallest is the Regione Lombardia Headquarters in Milan, which is 163 meters)

"It is not easy to find someone who is willing to spend a billion and a half of their money on the region," city governor Luca Zaia told Building Design magazine. "We needed a patron to reclaim this land and create an artistic symbol… our Eiffel Tower or Louvre pyramid."

The design features fin-shaped towers connected by horizontal rings. "Whether or not you like it, it will be a work of great architecture and engineering," the governor said.

Palais Lumiere, Venice © Pierre Cardin

Iberdrola Tower, Bilbao © Pelli Clarke Pelli

Art and tall buildings are also converging in Spain, where critics are citing the "Guggenheim effect" for the development of the 165-meter **Iberdrola Tower** in **Bilbao**. The project officially opened earlier this year, flying in the face of Spain's severe property issues.

Development of the César Pelli-designed tower, the tallest building in Basque country, was reportedly inspired by the desire to create more recognizable buildings, in the wake of the attention garnered by the world-renowned Guggenheim, Frank Gehry's classic work, which opened in Bilbao in 1997.

In **Warsaw**, BBI Development is teaming with the Roman Catholic Archdiocese of Warsaw to build a 180-meter tall office tower. The developer and the diocese formed a separate venture to build and manage the development, which has already been approved by local authorities. The tower

Wuhan Greenland Center © Adrian Smith + Gordon Gill

Competition Heating up for Tallest Titles

After years of relative calm, races for tallest building designations are once again making headlines around the world.

In China publications were buzzing with reports that Greenland Construction Group may increase the height of the **Wuhan Greenland Center,** in order to earn the title of tallest building in China. The tower is currently planned to reach 606 meters, placing it second behind the Shanghai Tower, which will stretch to 632 meters when it is completed in 2014, according to data compiled by the CTBUH's Skyscraper Center.

The Wuhan tower, which was designed by Adrian Smith + Gordon Gill Architecture, is scheduled for completion a year later, in 2015, at the earliest.

A similar race is shaping up in Canada, where Toronto developer Canderel added three floors to plans for the Aura tower, moving it up to 78 stories and ensuring it would become the tallest residential tower in Canada – and North America – after rival developer Tridel announced plans to build the 75-story Ten York.

"I think there is a lot of prestige now to living in the tallest condo in Canada," Riz Dhanji, Canderel's vice president of sales and marketing, told a local reporter.

That prestige is also up for grabs in Europe. The Shard in London topped off earlier this

Case Study: Capital Gate, Abu Dhabi

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Jeff Schofield
Since moving to RMJM Dubai in 2005, Jeff Schofield has lent his design expertise to a variety of large scale building developments, including mixed use, hospitality and high-rise projects.

As an Associate at RMJM, Jeff leads the effort in providing sustainable solutions to all design projects in the office. He has developed a holistic approach to design that integrates sustainability, structure and architectural expression with the built form, in order to provide meaningful solutions for high-quality building designs. Jeff seeks to design in a contemporary yet contextual manner, to create modern sustainable buildings using the latest technology.

Jeff currently lives and works in Dubai. He began his career in New York City and pursued his professional practice for more than 15 years in Paris, France. He has project management and design experience on a range of high profile projects and has specific experience in sustainable design and project management of large-scale public projects throughout Europe, United States and the Middle East.

"It is the first building in the world to use a pre-cambered core with a built-in lean of 350 millimeters that has been engineered to straighten with the addition of the upper floors. It is also the first building in the world to use vertical post-tensioning of the core to counter movement and support stresses created by the building's overhang."

Throughout history, a strong link has existed between iconic architecture and exhibitions. One of the best known examples is Paris' Eiffel Tower, which was built as a visual symbol of the Exposition Universelle, World's Fair of 1889. More recently, cities like Seville have used powerful and innovative architecture as a way to highlight the cultural significance of their exhibitions.

The Concept

In 2005, the Abu Dhabi National Exhibitions Company (ADNEC) was created to drive forward the development of Abu Dhabi's events sector. Plans were created with RMJM to build a state-of-the-art exhibition center which would be the largest in the Gulf region and provide world class facilities for live events to flourish in Abu Dhabi.

It was strongly felt that the entire development required a signature tower, a cutting-edge structure with a futuristic design, aesthetic splendor and technical excellence to celebrate human achievement and reflect the dynamism of Abu Dhabi. Capital Gate is the result.

The tower's curvaceous shape draws strongly on the sea and desert – two elements that have great resonance in Abu Dhabi. The building's form is meant to represent a swirling spiral of sand, while the curved canopy, known as the "splash," which runs over the adjoining grandstand and rises on one side of the building, creates a wave-like effect,

reflecting the building's proximity to the water and the city's sea-faring heritage.

By integrating with the National Day Grandstand – one of Abu Dhabi's most historic structures – Capital Gate underscores the bond between the traditional and modern that is characteristic of Abu Dhabi's developmental approach.

First of its Kind

There are several innovations within the project's design, including the dramatic 18-degree westward lean, which has earned it the title of "world's furthest leaning man-made tower" from the Guinness book of world records (see Figure 1). It is the first building in the world to use a pre-cambered core with a built-in lean of 350 millimeters that has been engineered to straighten with the addition of the upper floors. It is also the first building in the world to use vertical post-tensioning of the core to counter movement and support stresses created by the building's overhang.

The construction also adopted a variety of leading-edge approaches to create the desired result:

- Four hundred and ninety foundation piles were driven 20 to 30 meters underground to support the structure and counter stresses. The piles, which were initially in compression during construction to support the lower floors of the building, are now in tension as the stresses caused by the overhang have been applied.
- The vertical and horizontal cross-sections of the tower are all unique.
- There is an asymmetric shape – no two rooms are the same (see Figure 2). Every one of the 12,500 panes of glass on the façade is a different size, although each pane is triangular.
- Floor plates change shape and orientation to create the distinctive "overhang" moving from "curved triangular" to "curved rectangular," while increasing in overall size and migrating from east to west as they progress up the tower.
- Capital Gate is one of the few buildings in the world that use a diagrid structure; it also features two diagrid systems, an external diagrid defining the tower's shape and an internal diagrid linked to the central core by eight unique pin-jointed structural members.
- All 8,250 steel diagrid members are different thicknesses, length and orientation.

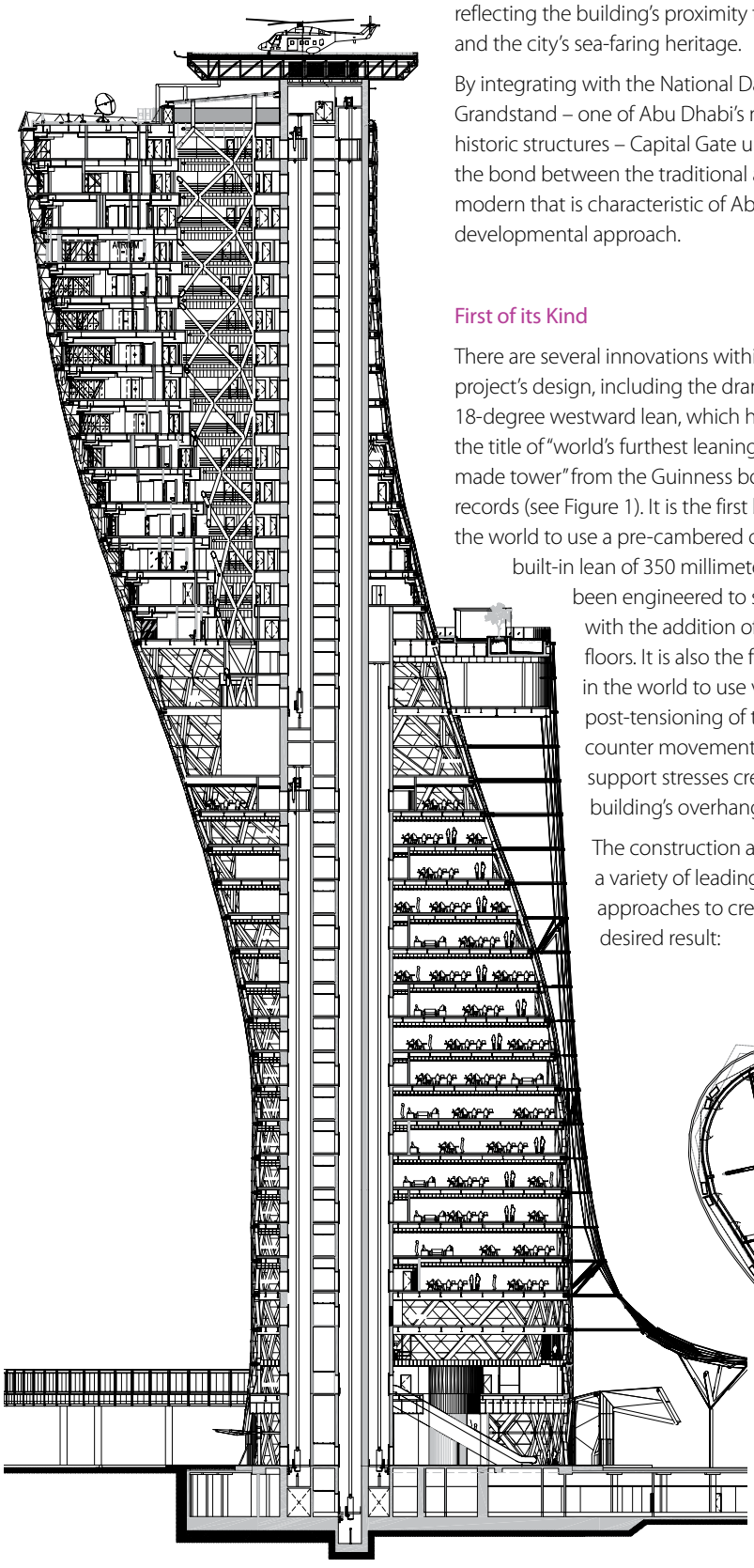

Figure 1. Typical section © ADNEC

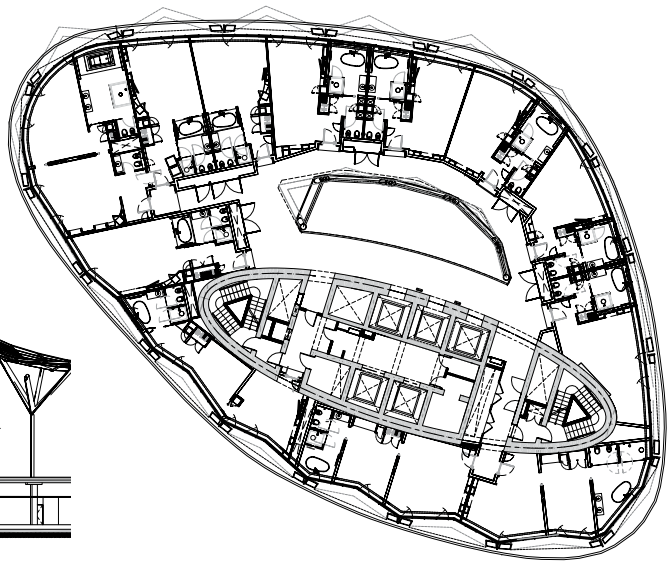

Figure 2. Typical hotel floor plan © ADNEC

The Environmental Performance of the TTDI


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Suraksha Bhatla
Suraksha graduated with honors from the School of Architecture and Planning, Anna University, Chennai in 2007 and went on to practice at T.R Hamzah and Yeang Sdn, Bhd in Kuala Lumpur. She was closely involved with the design phase of several large scale mixed-use, residential and commercial tower projects in Asia that were driven by sustainable concerns, including the Fusionopolis Office Tower, Singapore and PutraJaya Commercial Development, Kuala Lumpur, Malaysia. In 2009 she chose to return to academica and pursued her Masters in Sustainable Environmental Design at the Architectural Association, London. Her research at the AA, "Tall Communities: Passive Urban Housing for the Tropics" focused on the analytic exploration of basic bioclimatic strategies for hot humid climates and its consequent social impacts through passive design, with an emphasis on residential towers in keeping with the Asian mass housing market.

Joana Gonçalves
Joanna is an architect and urbanist from the faculty of Architecture and Urbanism of the Federal University of Rio de Janeiro, where she graduated in 1993. She practiced as an architect in Ana Maria Niemeyer SA, in Rio de Janeiro between 1992 and 1995. In 1996 she moved to London to study environmental design in the Architectural Association Graduate School, obtaining a MA degree from the Environment and Energy Studies Program in 1997. In the same year she moved to Sao Paulo to engage in teaching and research in the Faculty of Architecture and Urbanism at the University of Sao Paulo, where she received a PhD in 2003 with the thesis entitled, "The Sustainability of the Tall Building." Since 1998 she has been involved in teaching, research and consulting related to environmental design, collaborating with institutions in Brazil and in the U.K. Since 2009 she has been part of the teaching staff of the Masters Programme in Sustainable Environmental Design of the Architectural Association, London. In 2011 she was a visiting lecturer in the Harvard Graduate School of Design. Main research projects include the recent publication of the book *The Environmental Performance of Tall Buildings.*

"Through detailed analysis of occupant behavior, the predicted energy consumption patterns shown in modeling and performance assessment techniques can be further improved, challenging the preconceived theoretical notion of comfort and behavioral patterns."

Tropical Asia is accelerating towards vertical densification of its urban communities. With this movement comes an increase in the cooling demand in the building sector. Currently, it is estimated that 60% of the world's electricity consumption, usually affiliated with high CO_2 emissions, is attributable to residential and commercial buildings, creating the need to look at ways of reducing energy consumption in these buildings (Laustsen 2008). Although commonly classified as a typology of high-energy demand, tall buildings can be beneficial in hot, humid climates. Considering both urban and building scales, the typology enhances the exposure of the built form to wind flow, generates more wind at the ground level and provides desirable shadows upon the immediate surroundings.

Introduction

Across southeast Asia several proclaimed "bioclimatic towers" stand as examples of the contemporary environmental approach to tall buildings in the tropics, including the two residential towers of the Taman Tun Dr. Ismail (TTDI) condominiums in Kuala Lumpur (see Figure 1). Completed in 2006, the 21- and 28-story towers were designed by T.R Hamzah & Yeang, who is widely known for advocating his ideas on ecological architecture for the tropics. Ken Yeang's buildings are designed to encourage the inhabitants to connect with the natural environment through semi-outdoor transitional spaces and other elements which help reduce energy use. His design approach incorporates shading elements such as balconies, sky lobbies and *brise-soleil,* with shafts and structural cores often strategically positioned to buffer the interior spaces from solar exposure. Wind catchers are also commonly used to enhance natural ventilation and vertical landscaping is claimed to act as a means of facilitating micro climatic mediation (Yeang 1996).

To evaluate the effectiveness of these different strategies, including shading devices and wing walls, a review of the environmental performance of the TTDI tower was based on the outcomes of a post-occupancy evaluation (POE). This included real time data measurements of internal environmental conditions, namely temperature and humidity, interviews with the occupants and the assessment of energy bills. While the field work brings insight into the reality behind the various energy and thermal comfort demands of residents, it also sheds light on their adaptive behavioral response to environmental conditions and architectural features offered by principles of


Figure 1. Taman Tun Dr. Ismail (TTDI) condominiums, Kuala Lumpur © T.R Hamzah and Yeang

Base Case - Thermal Analysis Simulation (TAS) inputs		
Floor Area	100 m² (10 x 10 m)	
Floor Height	3 m	
W/F Ratio	25%	
Internal Gains	5562 kwh year	
Thermostat	Upper Limit 30 C	
	Lower Limit 18 C	
U-value	0.3 / 0.8 / 3.0 W/m²K	
Aperture Type	Natural Ventilation	partially open - 20C
		fully open - 28 C
Infiltration	0.5 ach	
Ventilation Rate	0 ach	

Table 1. Inputs for Base Case TAS model

bioclimatic design. Findings from the study, as well as a technical review, revealed the method and extent by which the annual cooling demand in residential tall buildings located in the tropical region can be curtailed. Figures as low as 5–7 kWh/m² per year in the best case scenario were found, mainly due to the occupants' behavior, which had a fundamental role to play in achieving strong environmental performance.

The Study

The POE was carried out in two phases: the first phase included a general survey in a group of flats, which in turn, informed a more detailed study of three residential units in the second phase of the evaluation. Prior to the case study, basic practices of environmental design for the tropics were tested in a series of analytical studies with the support of advanced simulation tools. The studies were carried out for the climatic context of Kuala Lumpur and supported the subsequent technical critical assessment of the TTDI residential complex.

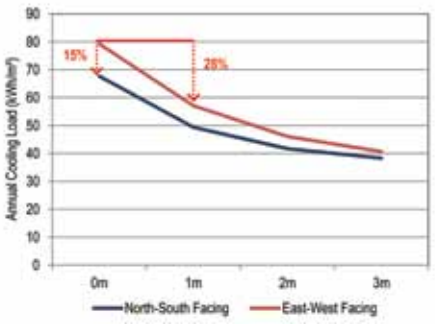

Figure 2. Relationship of annual cooling load and horizontal shading depth in different orientations, based on thermal dynamic simulations using EDSL, 2010 (TAS v 9.1)

The main aim when dealing with warm humid climates is to keep the building envelope protected from the typically high solar radiation, both direct and diffused, while ensuring effective heat dissipation by means of controllable ventilation. The tropical city of Kuala Lumpur (3.1˚N, 101.5˚E), has a warm, humid climate throughout the year with average hourly temperatures remaining at 27˚C for 76% of the year and humidity levels ranging between 60 to 80%. During the hottest period of the year, between February and April, external temperatures exceed 30˚C. In this context, the diurnal temperature differences range between 8 and 12 K, indicating the potential of night time cooling by means of natural ventilation (ASHRAE 2009a). Due to the proximity to the equator, Kuala Lumpur receives high levels of solar radiation (170–200 W/m² per day on the horizontal plane), highlighting the importance of shading. Apart from the direct component, the diffuse radiation is also high (>100 W/m²), as a consequence of high cloud cover that occurs for 80% of the year. Given the average monthly temperatures, based on Auliciems adaptive model (1981), a theoretical comfort zone was established as 22.9 –29.9˚C [1]. It is important to note that the prevailing winds in Kuala Lumpur blow mainly from west and southwest for most of the year, with an average speed below 2 m/s for 70% of the time.

Bioclimatic Strategies

In order to demonstrate the energy saving potential of passive strategies for tall buildings in the tropical context, the efficiency of shading was tested through computer simulation techniques using thermal analysis software [2]. Parametric studies were carried out using a base-case of a 10 x 10 meter residential unit positioned in an intermediate floor of a hypothetical tall building in Kuala Lumpur. Considering the limit of 29.9˚C established by the theoretical comfort zone, the annual cooling loads for the base case was simulated with the thermostat set point at 30˚C for a continuous occupation period of 24 hours (see Table 1). This set point was also determined based on research precedents [3] and findings from the fieldwork survey of TTDI residents, which identified the threshold temperature varying between 29˚C and 30˚C.

The performance of varying shading depths was analyzed for a 25% window to floor ratio[4], using north-south and east-west orientations. Looking at orientation only, 15% reduction of annual cooling loads was found when comparing the east-west to the north-south orientations. With the introduction of a one-meter horizontal shading device, the loads reduced further by nearly 28% (see Figure 2). With three-meter deep shading, the cooling loads reduce further to become similar for windows facing either north-south or east-west, making orientation a non-differentiating parameter for the environmental performance of the residential unit. In addition, simulations verified that there is no negative impact [5] on the internal daylight distribution for the given base case, even with a three-meter deep shading device (see Figure 3 and Table 2).

Insulation produced a perhaps surprising initial reduction of 42% in annual cooling loads by improving the U-value of the external walls from 3.0 W/m²K, which is

[1] Auliciems, A.(1981). The comfort equation (Tn = 17.6 + 0.31To ± 2.5°C) was used as the neutral temperature found, was closest to the values accepted by tropical subjects in fieldwork survey.
[2] Environmental Design Solutions Limited 2010, (TAS v 9.1) Dynamic thermal simulation TAS model uses hourly values of incident solar radiation and outdoor temperature, to simulate internal temperatures and cooling energy requirements based on a given set of specific internal environmental, constructional and occupancy conditions for the entire year.
[3] BUSCH (1992) Bangkok, Thailand (1100 surveys) 28.5 ET (NV) 24.5 ET (A/C). DeDear (1991) Singapore (583 NV/ 235 A/C surveys) 28.5 ET (NV) 24.2 ET (A/C). Indraganti, M. (2010) Hyderabad, India (100 surveys) 29.23 (NV).
[4] The 25% window to floor ratio (WFR) was chosen for the parametric studies, as simulation test results of different WFR and the consequent cooling load demand revealed that at this point the ventilation is effective, thereby causing a slight reduction in the cooling loads. Also mass housing schemes in the tropics usually use large glazing areas with WFR between 20–35%.
[5] Even with a 2.5-meter shading depth for 10x10 meter unit, double side lit, with a 25% window to floor ratio, it was found that the average daylight factors of 5% can be achieved above the recommended 1–1.5% for living spaces as per CIBSE 1999 (see Table 2).

About the Council

The Council on Tall Buildings and Urban Habitat, based at the Illinois Institute of Technology in Chicago, is an international not-for-profit organization supported by architecture, engineering, planning, development and construction professionals. Founded in 1969, the Council's mission is to disseminate multi-disciplinary information on tall buildings and sustainable urban environments, to maximize the international interaction of professionals involved in creating the built environment, and to make the latest knowledge available to professionals in a useful form.

The CTBUH disseminates its findings, and facilitates business exchange, through: the publication of books, monographs, proceedings and reports; the organization of world congresses, international, regional and specialty conferences and workshops; the maintaining of an extensive website and tall building databases of built, under construction and proposed buildings; the distribution of a monthly international tall building e-newsletter; the maintaining of an international resource center; the bestowing of annual awards for design and construction excellence and individual lifetime achievement; the management of special task forces/working groups; the hosting of technical forums; and the publication of the CTBUH Journal, a professional journal containing refereed papers written by researchers, scholars and practicing professionals.

The Council is the arbiter of the criteria upon which tall building height is measured, and thus the title of "The World's Tallest Building" determined. CTBUH is the world's leading body dedicated to the field of tall buildings and urban habitat and the recognized international source for information in these fields.

Council on Tall Buildings and Urban Habitat

Council on Tall Buildings and Urban Habitat

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