CTBUH Journal

Tall buildings: design, construction and operation | 2009 Issue II

Nakheel Harbour & Tower - The Vertical City

Condenser Typology

Seismic Evaluation: Nanjing Greenland Tower

40 years of the CTBUH: Publications

World's Tallest 50 Urban Agglomerations

SEI/ASCE Structures Congress 2009 Report

Fire & Safety Working Group Meeting Report

Council on Tall Buildings and Urban Habitat

CTBUH 40th Anniversary 1969-2009

"Towards a sustainable urban future"

Editor's Message

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Front cover: Nakheel Tower, Dubai © Nakheel

Zak Kostura, Editor

It is a tough time for sustainable design. The lingering recession continues to fuel a steady regression in the strides over recent years toward sustainability in the processes and products of industry. Reduced economic activity and restrained consumer spending has affected environmentally conscious investments in all sectors – from energy efficient vehicles and appliances to renewable power generation. According to a report from the International Energy Association, the latter may tumble this year 40% from where it was in 2008. Declines in both sales and investments across renewable markets – including a 50% drop in sales of the Toyota Prius in the first four months of this year – suggests that consumers see such items as luxuries that they can no longer afford.

Given these market statistics it would be possible to argue that the catalog of green products resulting from the recent wave of sustainable public consciousness was merely one of many indulgences synonymous with a period denoted by many – the notable architecture critic Nicolai Ouroussoff among them – as the "Age of Excess". Yet at least one market suggests otherwise: green buildings. Optimism thrives in indicators such as USGBC LEED certification rates and recent surveys of corporate real estate executives on "core business issues", jointly conducted by corporate real estate trade groups and advisory firms.

Why the discrepancy between green buildings and other green markets? The answer, in part at least, has to do with the lifetime of the investment.

This notion is backed up by Peter Morris, principal of the construction consultancy firm Davis Langdon, who noted in a March interview with Architectural Record, "if we buy the wrong TV we're saddled with it for a few years. If we buy the wrong sandwich we're only saddled with it for the afternoon. But if we buy the wrong building, we're saddled with it for far longer. What's happening now is that people are recognizing that building green creates long-term value, and that is a little different than long-term savings."

In the design of tall buildings, the lifetime of the product transcends localized, short-term market fluctuations, and implores investors, designers and developers to think long term. And there is diminishing discrepancy in forecasts of global climate trends. Climate change will outlast our recession, and in time it will with all likelihood regain holistic consumer attention, and with increased urgency.

In this issue of the CTBUH Journal, Matthew Wilson describes the conceptual use of condenser technology within tall buildings in arid climates. This system uses climate-controlling concepts known and used by mankind for centuries to promote natural ventilation and cooling in towers. Wilson expands on its potential use for occupied spaces as well as more novel programmatic uses such as agricultural development.

While the concepts expressed in this paper may be many years away from complete and effective implementation, they serve as useful examples of the long-term perspective critical to any tall building project, with an eye toward sustainability, and notwithstanding the present prosperity of the global markets. On behalf of the CTBUH editorial board, I hope you enjoy this issue of the Journal.

Best Regards,

Zak Kostura

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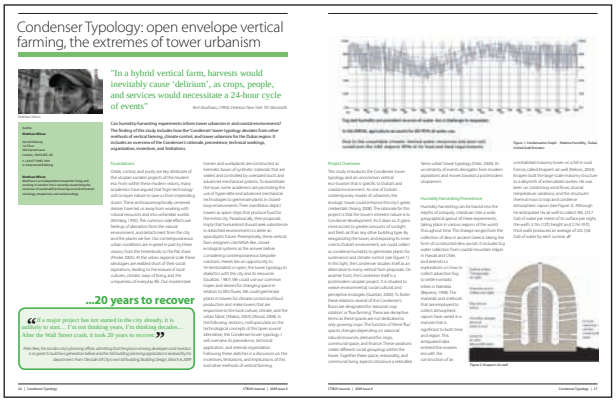

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"This cumulative seismic design effort has resulted in one of the tallest structures in the world to date and represents the state-of-the-art in performance-based evaluation."

Charles M. Besjak, page 36

Visit www.ctbuh.org for more on the global tall building industry and the Council on Tall Buildings and Urban Habitat

Global News

The CTBUH Global News Archive is an online resource for all the latest news on tall buildings, urban development and sustainable construction from around the world. Each issue, the CTBUH Journal publishes selected feeds from the online archive. For comprehensive industry news, visit the Global news Archive at: http://news.ctbuh.org

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President Obama recognizes CTBUH Former Chair Dr. Fazlur Rahman Khan

In an address to the Muslim world, President Barak Obama paid tribute to the American Muslims who have enriched the United States, including Dr. Fazlur Rahman Khan who "built our tallest building". Dr. Khan was known as the visionary and legendary structural engineer who designed the 110-story Sears Tower, which featured his innovative "bundled tube" design. Born in Dhaka, Dr. Khan graduated from the University of Illinois at Urbana-Champaign then joined the firm of Skidmore Owings & Merrill where he became partner in 1966.

With strong ties to Dr. Lynn Beedle and the Council on Tall Buildings and Urban Habitat, Dr. Khan became chairman of CTBUH from 1979 until his untimely death in 1982. In 1983 Dr. Beedle began a campaign to raise money for an endowment to honor his colleague and close friend. This effort resulted in the endowing of a Fazlur Rahman Khan Chair in structural engineering and architecture at Lehigh University in Bethlehem, PA. Prof. Dan. M. Frangopol, an expert in structural reliability, optimization and life-cycle engineering was appointed as the first holder of the Khan Chair. His creation of the Khan Lecture Series, sponsored by Lehigh University's Department of Civil & Environment Engineering and the Department of Art & Architecture, honors Dr. Khan's legacy of excellence in structural engineering and architecture, bringing top level building professionals to Lehigh University each spring.

Dr. Fazlur Rahman Khan (1929-1982), one of the foremost structural engineers of the 20th century, epitomized both structural engineering achievements and creative collaborative efforts between architects and engineers. His ideas for his sky-scraping towers offered more than economic construction and iconic architectural images; they gave people the opportunity to work and live 'in the sky'.

© Allies & Morrison

Heart of Doha masterplan

The first phase of the 'Dohaland' masterplan for the old city of Doha, Qatar has broken ground on 3 March. The first phase is called 'Heart of Doha'. This important part of old Doha, around Kahraba, Abdulla Bin Thani, and Musherib streets, has lost its rich community over the years. According to Issa al-Mohannadi, CEO of Dohaland, "The area's residents have migrated to other regions, leaving much of the historic neighborhood neglected. Today, we aim to restore the lost luster to a location that is close to our hearts, we want to bring it back to life."

The mixed-use development will feature a total of 226 buildings. It will be adjacent to the Emiri Diwan seat of government and the ruler's palace, along with the new Souk Waqif. The development will include a national archive, museum, heritage quarter, theatre, and hotels. Total population is projected to be 27,637 by the year 2016.

The design team includes Allies and Morrison along with Arup and Edaw.

© Carlos Zapata Studio

Vietnam's tallest tower

The tallest tower in Vietnam is being built in Ho Chi Minh City (formerly Saigon). At 74 stories and 262.5m, Bitexco Financial Tower will be the tallest building to rise in Vietnam, joining the ranks of other Asian nations with tall towers. The 100,000 sqm tower will contain Class A office space and cost US$220 million to construct.

It is shaped like a lotus petal, a reoccurring theme in Vietnamese culture. It was originally planned to be taller but was reduced in height in 2008. Some have compared its shape to the Menara Telekom in Malaysia. After a year of construction, the foundation is complete and it has risen to six stories. The architect is Carlos Zapata Studio & AREP.




© Top left to bottom right: Smith Carter Architects and Engineers Inc.; Steven Holl Architects; Skidmore, Owings & Merrill LLP; and CICO Consulting Architects & Engineers

CTBUH 2009 Award Winners Announced

The Council on Tall Buildings and Urban Habitat has announced the winners of its annual "Best Tall Building" awards for 2009, recognizing one outstanding tall building from each of four geographical regions: Americas, Asia & Australia, Europe, and Middle East & Africa. This year's winners are (see images above top left to bottom right):

- Manitoba Hydro Place, Winnipeg , Canada
- Linked Hybrid, Beijing, China
- The Broadgate Tower , London, UK
- QIPCO Tower, Doha, Qatar

One of these four will be named "Best Tall Building Overall" at CTBUH's October awards dinner, to be held in Mies van der Rohe's seminal Crown Hall, Chicago on Thursday 22nd October, 2009.

The CTBUH also announced the winners of its two "Lifetime Achievement" Awards. This year's recipients are John C. Portman, Jr. (Lynn S. Beedle Award) and Dr. Prabodh V. Banavalkar (Fazlur Rahman Khan Medal).

More at: http://awards.ctbuh.org

© Louis Karol

Cape Town skyscraper

The Portside project in Cape Town, South Africa has won city approval and started construction. Designed by architect Louis Karol, it is the first post-apartheid skyscraper to be built in South Africa. It is a multi-use building that will contain 24 floors of office above 5 floors of hotel and retail spaces.

The tower will strive to achieve a four-star rating from the Green Building Council of South Africa. According to Brent Wiltshire, an executive of the developer OMIGPI, "Tall Buildings play an important role in green architecture and their role is three-fold – to promote sustainability, reduce energy use and develop innovative technologies."
The last skyscraper constructed was in 1993. There are many reasons for this delay in skyscraper construction in South Africa. Some of the reasons include low economic confidence and conservative planning policy. Completion of the Portside project is scheduled for April 2011.

© Studio Daniel Libeskind

Archipelago 21 in Seoul

Studio Daniel Libeskind has won an international competition to develop a new master plan for central Seoul, South Korea. To eventually include 34 million sq ft of occupied floor space, the plan has been described as 'islands within a sea of green park space'. It is located along the Han River.

The master plan is intended to transform central Seoul into an international business district. It will include neighborhoods of residential, office, and retail clusters within urban parks. The neighborhood clusters will also contain cultural and educational facilities. Rapid transport systems will link all of the clusters to the city.

Each neighborhood cluster is to be distinctive and vibrant. As a 21st century destination, they are to reflect the cultural complexity of Seoul. Groundbreaking is expected in 2011 with completion in 2016.

...greater paris

"We need to think big."

Statement by French President Sarkozy as he revealed ten works by architects to help redesign a 'Greater Paris.' From 'Sarko's €35bn rail plan for a 'Greater Paris'" The Independent, UK. April 29, 2009

Case Study: Nakheel Tower – The Vertical City

Mark Mitcheson-Low

Ahmad Rahimian

Dennis O'Brien

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Mark Mitcheson-Low
Mark has an expansive portfolio of major projects in all sectors of design across the world in his 30 years of experience in Architecture. Projects include mixed use developments of commercial, retail, hospitality and residential sectors and major projects in transportation, education, and infrastructure developments. Mark has been a director since 1998 and joined Woods Bagot in 1986. His role has included the development of new markets and the procurement and design management of a diverse range of projects across the globe.

Ahmad Rahimian
With over 28 years of experience, Ahmad, an internationally recognized expert in tall buildings, is president of WSP Cantor Seinuk, a leading structural engineering firm based in New York and part of WSP Group PLC. He is the recipient of 2007 AISC Special Achievement Award, 2005 ASCE-CERF Charles Pankow Award and ENR -Top 25 Newsmakers Award of 2003. Among many notable projects, he directed the structural engineering of the Trump World Tower and Hearst Tower, New York; and Torre Mayor, Mexico City.

Dennis O'Brien
Dennis O'Brien is the Deputy CEO for the International Group and Regional Director for Middle East. Dennis established the office in Dubai following NDY, appointment as Building Services Consultants for the Nakheel Tall Tower. In addition to roles on the Board of the Company, he is responsible for areas of Quality Assurance and Risk Management for the International Group. He is also active in assisting international offices in concept design and design reviews for major projects.

"The Nakheel Tower is a feat of design intelligence on all levels and across all disciplines – it truly is a mark of the epoch. It is an example of the resilience of the human spirit to overcome the forces of nature to create a monument dedicated to past, present and future generations of the Gulf."

Nakheel Harbour & Tower, Dubai's new capital, will be a beacon of inspiration for the region and the world, incorporating elements from Islamic culture. Encompassing more than 270 hectares, this mixed-use development will be located in the heart of New Dubai, and will include the world's tallest building, a harbour, cultural podium and residential districts. Nakheel Tower in itself will be a vertical city, accommodating residents in an efficient LEED rated, sustainable building. This is the world's first true, very tall mixed use development combining offices, a 5 star hotel, luxury residential and serviced apartments, an experience centre and observation facilities along with a special sky function space – creating a vertical community of over 15,000 people (see Figure 1).

The lessons learned from the Nakheel Harbour Tower hold implications for future buildings of this magnitude. Although the technical difficulties associated with such a large project are many, none are insurmountable. This provides optimism for the future of tall building design and demonstrates the possibilities in building towers that reach higher than any that have come before.

Figure 1. Nakheel Harbour & Tower

Architecture

Global design practice Woods Bagot were appointed as the Architects for the Nakheel Tower and Masterplanner for the harbour precinct in 2006.

Building on the theories of past visionaries such as Le Corbusier, Frank Lloyd Wright and Paolo Soleri, the Nakheel Tower is the first, true realisation of a vertical city. Over 15,000 inhabitants will live, work and socialise all within a footprint smaller than a New York City block. With the ever-changing global environmental climate affecting not only Dubai, but the world as a whole - The Nakheel Tower seeks to reduce the human impact on the environment by being a beacon of passive ESD initiatives, striving to counteract and minimise its carbon footprint by intelligent design solutions and reducing urban sprawl (see Figure 2).

Figure 2. Nakheel Harbour & Tower Plan

Reaching heights of over one kilometer was made possible by implementing a design concept that divided the Tower into four separate towers. Typical tall buildings are usually planned around a single, central core and taper towards the top to mitigate the wind forces. In contrast, the Nakheel Tower deals with the issues of wind by allowing the wind to pass through the tower, rather than around it. This is achieved by incorporating two slots through the height of the tower which effectively creates four separate towers, each with their own core and structurally linked at every 25 levels by "skybridges". Each of these skybridges acts as a "podium" for each of the tower sections above it. The end result is large floor plates at high levels as the tower does not taper as it gets taller (see Figures 3a+b).

Figure 3a. Tower Components

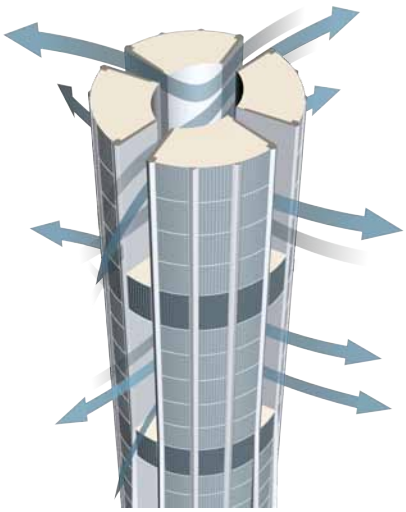


Figure 3b. Slots through Nakheel Tower allow wind to pass through

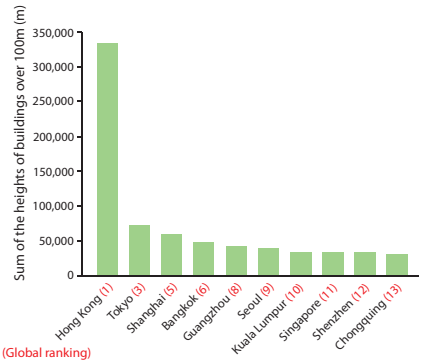
Tall Buildings In Numbers

World's Tallest 50 Urban Agglomerations, Projected 2010

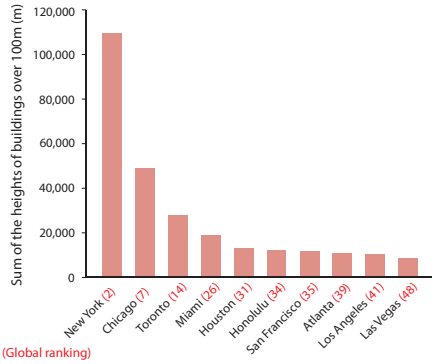
Rank[1]	City	Country	Urban Agglomeration Population[2]	City Population[3]	# of Buildings over 100m[4][6]	Combined Heights (m)[5][6]	People/Meter[6]	People/ Building[6]
1	Hong Kong	China	7,200,000	6,857,100	2354	333,836	22	3,059
2	New York	USA	21,900,000	8,143,197	794	109,720	200	27,582
3	Tokyo	Japan	33,800,000	8,489,653	556	73,008	463	60,791
4	Dubai	UAE	1,540,000	1,089,000	403	66,248	23	3,821
5	Shanghai	China	17,900,000	14,348,535	430	59,958	299	41,628
6	Bangkok	Thailand	8,750,000	6,858,000	355	48,737	180	24,648
7	Chicago	USA	9,850,000	2,842,518	341	48,441	203	28,886
8	Guangzhou	China	15,300,000	8,524,826	295	42,865	357	51,864
9	Seoul	South Korea	23,900,000	9,895,217	282	39,308	608	84,752
10	Kuala Lumpur	Malaysia	4,700,000	1,145,342	244	34,035	138	19,262
11	Singapore	Singapore	4,700,000	4,483,900	238	33,735	139	19,748
12	Shenzhen	China	9,400,000	7,008,831	235	33,435	281	40,000
13	Chongqing	China	6,350,000	5,087,197[a]	226	31,475	202	28,097
14	Toronto	Canada	5,650,000	2,503,218	216	27,867	203	26,157
15	Panama City	Panama	1,330,000	484,261	185	27,478	48	7,189
16	Manila	Philippines	19,200,000	1,581,082	186	26,307	730	103,226
17	Jakarta	Indonesia	15,100,000	8,640,184	170	23,674	638	88,824
18	Sao Paulo	Brazil	21,000,000	11,016,703	194	22,794	921	108,247
19	Osaka	Japan	16,700,000	2,628,811	172	22,754	734	97,093
20	Beijing	China	13,200,000	11,509,595	172	22,192	595	76,744
21	Macau	China	502,113	498,852	131	19,597	26	3,833
22	Moscow	Russia	13,500,000	10,433,869	132	18,504	730	102,273
23	Tianjin	China	8,200,000	7,499,181	131	18,259	449	62,595
24	Nanjing	China	4,700,000	3,624,234	110	16,784	280	42,727
25	Mumbai	India	22,300,000	11,914,398	118	16,331	1,365	188,983
26	Miami	USA	5,500,000	386,417	137	18,385	299	40,146
27	Buenos Aires	Argentina	13,800,000	2,965,403	122	15,254	905	113,115
28	Sydney	Australia	4,400,000	4,255,954	102	13,933	316	43,137
29	Mexico City	Mexico	22,900,000	18,204,964	114	13,862	1,652	200,877
30	Dalian	China	3,450,000	3,245,191	93	12,803	269	37,097
31	Houston	USA	5,800,000	2,016,582	86	12,614	460	67,442
32	Doha	Qatar	370,700	339,847[b]	78	12,254	30	4,753
33	Istanbul	Turkey	12,500,000	9,555,719	90	11,897	1,051	138,889
34	Honolulu	USA	876,156	377,379	104	11,855	74	8,425
35	San Francisco	USA	7,300,000	739,426	88	11,582	630	82,955
36	Wuhan	China	9,000,000	8,312,700	79	11,236	801	113,924
37	Busan	South Korea	3,700,000	3,662,884	64	10,556	350	57,813
38	Shenyang	China	5,150,000	4,596,785[c]	76	10,479	491	67,763
39	Atlanta	USA	5,700,000	470,688	73	10,471	544	78,082
40	Chengdu	China	5,600,000	4,333,541	81	10,453	536	69,136
41	Los Angeles	USA	18,000,000	3,844,829	70	10,062	1,789	257,143
42	Melbourne	Australia	3,900,000	3,635,508	69	9,868	395	56,522
43	Paris	France	10,000,000	2,125,017	78	9,558	1,046	128,205
44	Qingdao	China	3,275,000	2,720,972	68	9,404	348	48,162
45	Rio de Janeiro	Brazil	12,500,000	6,136,652	73	8,867	1,410	171,233
46	Xiamen	China	1,990,000	1,454,450	66	8,584	232	30,152
47	Hangzhou	China	4,025,000	2,451,319	62	8,463	476	64,919
48	Las Vegas	USA	1,950,000	545,147	59	8,241	237	33,051
49	Dallas	USA	6,350,000	1,213,825	53	7,879	806	119,811
50	Tel Aviv	Israel	3,200,000	381,650	59	7,679	417	54,237

Region	Number of Tallest 50 Urban Agglomerations	% of Tallest 50 Urban Agglomerations
Asia	26	52%
North America	11	22%
Middle East	3	6%
South America	3	6%
Europe	3	6%
Central America	2	4%
Australasia	2	4%

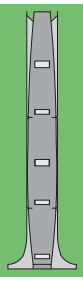
10 Tallest Urban Agglomerations in Asia



10 Tallest Urban Agglomerations in North America



Credits: Marshall Gerometta, Paul Kazmierczak, Matthew Lacey, Philip Oldfield, and Antony Wood

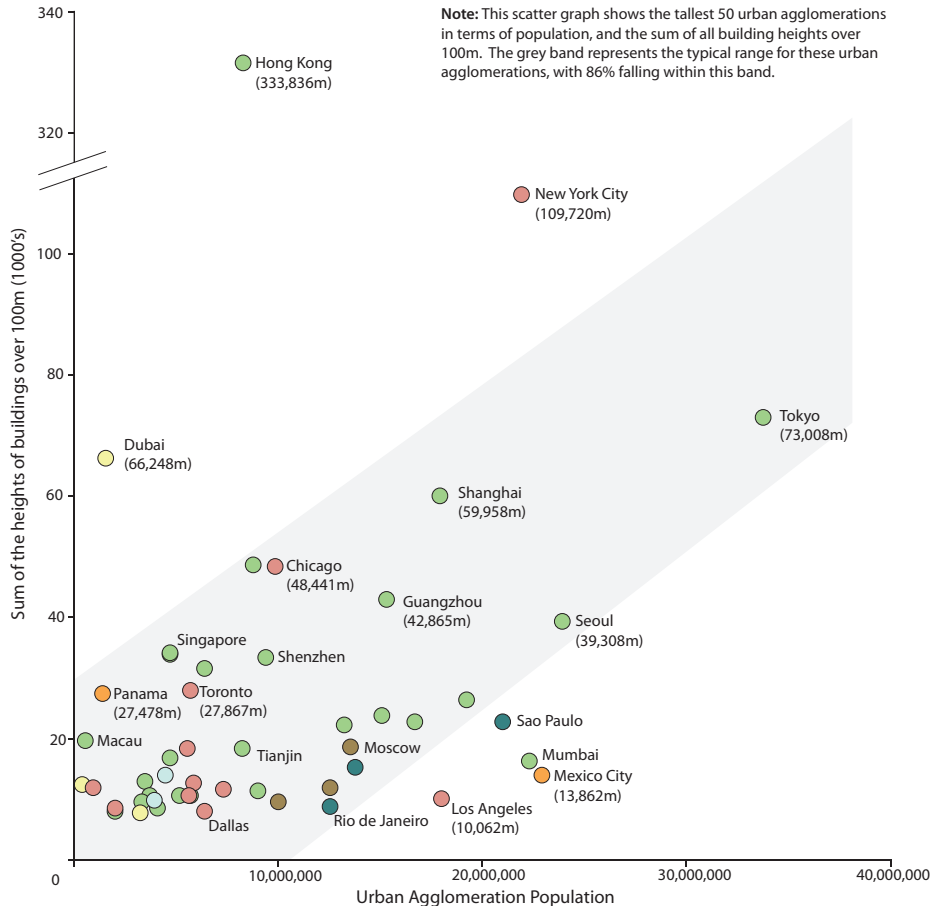


Hong Kong has more buildings over 100m than the next 4 cities combined (New York, Tokyo, Dubai, and Shanghai).

Only 3 of the 50 tallest urban agglomerations have a population less than 1 million people- Doha, Macau, and Honolulu.

For every building over 100m in Los Angeles there are over a quarter of a million people, whereas in Hong Kong there are just over 3,000 people.

Combined Heights of buildings over 100m vs. Urban Agglomeration Population



For an expanded version of this research please visit: www.TallestAgglomerations.ctbuh.org

Notes to table on the far left: '*World's Tallest 50 Urban Agglomerations, Projected 2010*'

(1) Rank determined by the combined height of all tall buildings greater than or equal to 100m in height within the urban agglomeration.

(2) Urban Agglomeration is defined as a city (or group of cities) in association with surrounding suburbs that create a continuous built up area where the population is economically and culturally linked to the city (or cities). Urban Agglomeration population data taken from Thomas Brinkhoff: City Population, http://www.citypopulation.de

(3) City is defined as an urban area determined according to legal/political boundaries that is usually characterized by some form of local government. Population data taken from United Nations Statistics Division, 2006 Demographic Yearbook, Table 8: Population of capital cities and cities of 100 000 and more inhabitants: latest available year, 1987-2006 (Released: 29 July 2008), unless otherwise noted.

(4) Building count includes the buildings the CTBUH expects to be completed by the end of 2010.

(5) Due to a lack of publicly available building height information, in some instances building height has been estimated from the building story count. In these instances the formula:

Hunknown = 3.55s + 9.75+ 2.65(s/25)
has been utilized where:
s = Storey Count
H = Building Height

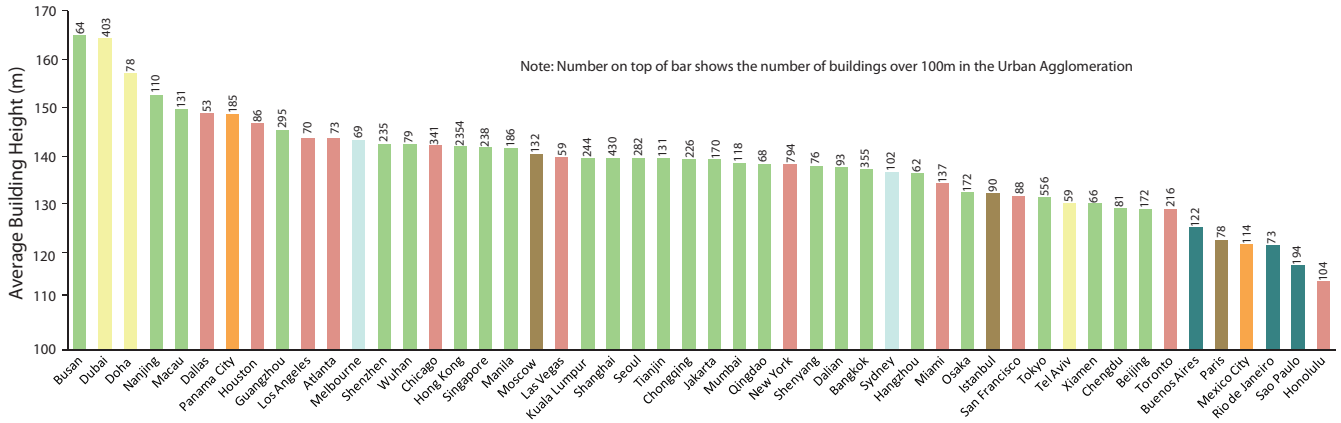
To see how formula was arrived at please visit www.HeightCalculator.ctbuh.org

(6) Numbers relate to urban agglomeration, not city

a c d City population data from: http://www.citypopulation.de

b City population data from Qatari Census 2004.

Average Height of Buildings over 100m in the World's Tallest 50 Urban Agglomerations



Panama City is the tallest city in the Americas outside the USA/Canada, with a comparable number of tall buildings to Sao Paulo, but only 6% of the population of the Brazilian city.

7 of the 10 tallest urban agglomerations in the world are located within a 2,000 mile radius of Hong Kong.

The combined heights of the buildings over 100m in the 3 tallest European cities (Moscow, Istanbul, and Paris) is less than the combined heights of buildings over 100m in Guangzhou, China

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 actively undertakes research into relevant fields in conjunction with its members and industrial partners, and has in place an international 'Country Representative' network, with regional CTBUH representatives promoting the mission of the Council across the globe.

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

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