

CTBUH Journal

International Journal on Tall Buildings and Urban Habitat

Tall buildings: design, construction and operation | 2010 Issue II

Case Study: Shanghai Tower

The Vertical Garden City:
Towards a New Urban Topology

Innovative 20: Challenging the
Typology of Tall Buildings

Tall Buildings, Structural
Systems and Materials

Talking Tall: Winy Maas, MVRDV

CTBUH Mumbai Conference Report

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Zak Kostura, Co-editor

I would like to offer an enthusiastic welcome to Jan Klerks, who stepped up in February to begin serving as a co-editor of the Journal alongside myself. Jan brings with him a talent for writing journalistically about tall buildings, their designers, and the inspiring visions for future urban areas currently being explored through simulations, competitions and construction projects worldwide and likewise under the lens of the CTBUH. His input will help ensure a forward-facing stance for the Journal and the dissemination of these projects and visions within its pages.

We celebrate several such visions in this issue with the first formal interview of a tall building designer, Winy Maas of MVRDV in Rotterdam. Through bold concepts that include undulating, artificial hillsides, stacked oceans and "pigscrapers", Maas looks to redefine the balance between nature and artifice in our global cities. In this profile, compiled by Jan following a visit to the design firm late last year, innovative interpretations of future society are celebrated, and we are reminded that our work today will in fact help shape the world we live in later. This "Talking Tall Interview" will become a regular feature of the Journal moving forward.

While firms such as MVRDV demonstrate ways in which industry can shake off convention, it is often within the realm of academia that we find some of the most unconventional work. Chris Abel, who highlights the work of

students at the Universities of Sydney and New South Wales on a new urban typology dubbed the "Vertical Garden City", showcases such new and intriguing work in this issue. This coverage follows a report on the designs of students at the Illinois Institute of Technology for the remaking of Mumbai in Issue I of this year by professor and CTBUH executive director Antony Wood. In both pieces, we see new ways of implementing aspects of environmental sustainability and cultural amenity, which can be gleaned by those in professional practice who continue to seek better ways to build tall buildings and holistic urban areas.

On behalf of the Council, I hope that you find these concepts inspiring. In addition to his great work on the journalistic side of this publication, Jan has launched a discussion forum on the CTBUH page on LinkedIn. Please visit this at <http://LinkedIn.ctbuh.org>. We invite you to join this discussion and share your thoughts on these novel visions with other members as we continue to explore creative ways of improving our built environment.

Cheers,

Zak Kostura

News and Events

- 04 **CTBUH Leader's Message**
William Baker, CTBUH Trustee
- 05 **CTBUH News and Events**
Antony Wood,
CTBUH Executive Director
- 05 **What's on the Web**
Featuring new content now
available on the CTBUH
website
- 06 **Global News**
Highlights from the CTBUH
global news archive

Case Study

- 12 **Case Study: Shanghai Tower**
Jun Xia, Dennis Poon &
Douglas C. Mass

Research

- 20 **The Vertical Garden City: Towards a New Urban Topology**
Chris Abel
- 32 **Innovative 20**
Marshall Gerometta,
Nathaniel Hollister, Matthew
Lacey, Philip Oldfield &
Antony Wood

Features

- 36 **Talking Tall Interview**
Winy Maas, MVRDV
- 40 **Tall Buildings in Numbers**
Tall Buildings, Structural
Systems and Materials
- 48 **Exhibit Review**
China Prophecy: Shanghai
- 48 **Book Review**
Reinforced Concrete Design
of Tall Buildings
- 49 **Diary**
What's coming up?

CTBUH

- 19 **Letters to the Editor**
Feedback and Comments
- 42 **CTBUH 2010 Mumbai Conference**
Overview of latest CTBUH
conference
- 50 **Profile: JuHwan Cho**
CTBUH Country Representative
South Korea
- 50 **Profile: José Romano**
CTBUH Country Representative
Portugal
- 51 **CTBUH Organizational**
Structure & Member Listings

12

Case Study: Shanghai Tower



"Shanghai Tower, which will anchor the city's Lujiazui district as one of the world's foremost commerce destinations, isn't simply about a single high-rise building. It represents a new way of envisioning and creating cities, and it addresses the tremendous challenges that face designers of supertall buildings today."

Key Design Challenges
The tower's design is a response to the unique challenges of building a supertall structure in a dense urban environment. The design team had to address a variety of issues, including wind resistance, structural stability, and the need for a highly efficient and sustainable building system. The tower's unique twisted form and tapered profile are a result of these challenges, as well as the desire to create a building that is both iconic and functional.

Key Design Solutions
The design team employed a variety of innovative solutions to address the challenges of building the Shanghai Tower. These included the use of a highly efficient and sustainable building system, the implementation of a highly advanced wind resistance system, and the use of a highly innovative structural system. The tower's unique twisted form and tapered profile are a result of these solutions, as well as the desire to create a building that is both iconic and functional.

20

The Vertical Garden City: Towards a New Urban Topology



"Understandably, architects have abandoned the flawed urban visions of the past century to focus on the new technologies of production and other more immediate issues. However, having now finally mastered the 'how' of production in the digital age, designers need to reflect on the 'what', and to re-imagine the shape of the modern city to meet the urgent challenges of this century."

Key Design Challenges
The article discusses the challenges of creating a new urban topology in the digital age. It highlights the need for designers to move beyond traditional urban planning and to embrace new technologies and production methods. The article also discusses the need for designers to re-imagine the shape of the modern city to meet the urgent challenges of this century.

Key Design Solutions
The article proposes a number of innovative solutions to address the challenges of creating a new urban topology. These include the use of new technologies and production methods, the implementation of a highly advanced urban planning system, and the use of a highly innovative structural system. The article also discusses the need for designers to re-imagine the shape of the modern city to meet the urgent challenges of this century.

42

CTBUH 2010 Mumbai Conference



"One cannot tell Mumbai how to shape the future as it has to be shaped by the people of Mumbai themselves. The future of the city is in their hands."

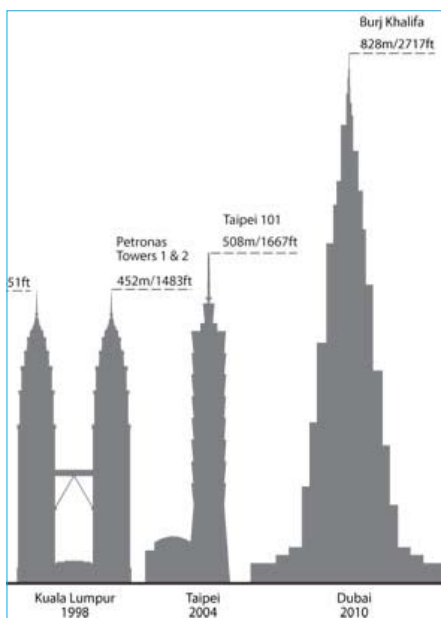
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“As a result, every floor of the building is both unique and generic. As such, the pixilated volume makes the generic specific...”

Winy Maas, page 36

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



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CTBUH ratifies official height and "World's Tallest" status of the Burj Khalifa

The Council on Tall Buildings and Urban Habitat has received and examined detailed drawings of the Burj Khalifa submitted by building owner Emaar, and can now confirm the official building height at 828.00 meters (2716.54 feet), as well as the title of "The World's Tallest Building". With the official completion of the building on January 4th, 2010, the Burj Khalifa surpassed the previous "World's Tallest" (Taipei 101) by 320 meters, an unprecedented increase of 61%. The Burj Khalifa has become the 16th building to hold the title of the "World's Tallest" and stands an additional 773 meters higher, or 15 times taller, than the world's first "tall building" (the Home Insurance Building completed in Chicago in 1885).

125 years on from the completion of the first skyscraper, the tall building typology continues to evolve at a rapid pace. The Burj Khalifa exemplifies four major trends in current tall building construction, with respect to location, function, structural material and height.



© Office of Metropolitan Architecture

Television Cultural Center to be Renovated

The hotel tower that is part of the CCTV complex in Beijing will be renovated. The Television Cultural Center building suffered a devastating fire during the Chinese Lunar New Year in 2009. An investigation of the charred structure has been performed to determine its structural integrity. A committee of the State Council has determined that renovations can begin because the tower is structurally safe.

The exterior had a metal framework that was badly damaged in the fire. The interior has a concrete core that suffered no damage. The fire occurred just weeks before it was to open as a hotel. The Mandarin Oriental Hotel Group has indicated that it will proceed to renovate the structure into a hotel.

The CCTV complex was designed by the Office for Metropolitan Architecture. It includes the Television Cultural Center and the better-known square doughnut-shaped CCTV tower.



© Rafael Viñoly Architects

20 Fenchurch Street project shows signs of activity in London

Land Securities may revive the 20 Fenchurch Street project in central London. Even though the city has been in tough economic times, a rebound may produce demand for office space. The tower was designed by Rafael Viñoly Architects and contains 59,000 square meters of office space with a skygarden. It will be 160 meters tall and has been dubbed the "Walkie Talkie" because of its shape.

There is a definite lack of activity in the London cityscape. The current rate of activity is at its lowest since 1984. This may change as the economy continues to pull out of its present doldrums. With few office towers started in the last several months, demand may return for

...design of space

“Architecture is the design of space, both interior and exterior. So it's much more closely related to dance than it is to painting or sculpture.”

Quote of Bruce Graham from a 1999 interview. Mr. Graham passed away on March 6, 2010. Mr. Graham was a partner of SOM, designing the Willis (Sears) and the John Hancock Towers alongside Fazlur Khan, amongst others. From the article "Towering Figure", Chicago Sun-Times, March 10, 2010.

quality office space. After an economic review, Land Securities may begin moving forward with the project again. If the economy does improve in the coming years, the tower's projected completion date of 2013 or 2014 may fall into an upward economic cycle. Since few new towers will have been constructed at this projected time, the 20 Fenchurch Street tower may become a good investment for Land Securities.



© Rogers Stirk Harbour + Partners

Barangaroo Development Controversy in Sydney

In a 2006 competition, a conceptual design was established to develop a waterfront site at Sydney harbor. The winning developer of the competition was Lend Lease. A main component of the Barangaroo development is providing open recreation space for the public, among other amenities. The site was industrial but is now prominent on the waterfront. It is proposed to become a gateway to Sydney.

The site is a former dockland within Sydney harbor. It has been the intent to keep the waterfront accessible to the public. A new proposal for a hotel constructed literally in the water has caused some controversy. Designed by Rogers Stirk Harbour + Partners, the proposed hotel tower would be constructed

on a pier in the water. Besides providing unobstructed views of the harbor and skyline from the tower, it would also block views from the waterfront open space. Some have criticized the design as breaching the height and density restrictions of the approved concept plan.



© Henn Architekten

Commercial Bank of Ethiopia Competition Winner

A consortium of designers has won the competition for the headquarters of Commercial Bank of Ethiopia in Abbis Ababa. The designers include Henn Architekten, Transsolar Energietechnik, Happold Ingenieurburo, and Priedemann Fassadenberatung all of Germany, and local firm Universal Consultants of Ethiopia.

The project will have a base containing a conference center, shopping mall and sunken landscaped plaza. The tower is 42 stories of banking and executive offices. The net area of the project will be a total of 50,000 square meters. Located in the central business district of Addis Ababa, the headquarters is to convey a sense of security and trustworthiness as well as improve Addis Ababa's image as a world-class metropolis.

The tower is not purely rectilinear but has vertical slots in the east and west facades. These are to emphasize the entry and to provide views from the upper executive floors to the cityscape. The volumes of the conference center and shopping mall have also been separated to blend with the surrounding neighborhood's massing. Open spaces between each function form the plaza areas.



© Pickard Chilton

New Office Headquarters Anchors Downtown Redevelopment

Devon Energy Corp., an independent energy company, is constructing a new headquarters in Oklahoma City. Designed by Pickard Chilton and Kendall / Heaton Associates, the Devon World Headquarters is a main component of the redevelopment of downtown Oklahoma City. The tower's base includes a podium of amenities, to support the downtown community, with office space above. Total floor area of the project will be 1,900,000 square feet.

After decades of neglect, Oklahoma City has decided to redevelop its downtown. One project that will anchor this transformation is this new Devon World headquarters. ➤

Case Study: Shanghai Tower



Jun Xia



Dennis Poon



Douglas C. Mass

"Shanghai Tower, which will anchor the city's Lujiazui district as one of the world's foremost commerce destinations, isn't simply about a single high-rise building. It represents a new way of envisioning and creating cities, and it addresses the tremendous challenges that face designers of supertall buildings today."

Authors

Jun Xia, Principal and Design Director of Gensler, Shanghai; **Dennis Poon**, Managing Principal at Thornton Tomasetti; **Douglas C. Mass**, PE, LEED AP, President/Principal-in-Charge of Cosentini Associates

Jun Xia¹

Jun Xia, Principal and Design Director of Gensler's Shanghai office, is an award-winning architect. Jun holds a bachelor of architecture degree from Tongji University in Shanghai and a master of architecture in Urban Design from University of Colorado at Denver. He is noted for his ability to render complex building issues into accessible terms for his clients, leading to better design collaboration throughout the construction process. Jun's Chinese projects are noted for their visionary qualities, and include master plans for Shanghai Shipyard and Nanjing Road West, office buildings including ChangAn International Center and China Petrochemical HQ in Beijing, among others.

Dennis Poon²

Dennis Poon is a Managing Principal at Thornton Tomasetti, Inc., a 550-person, privately held structural engineering firm. Mr. Poon has more than 30 years experience in the structural engineering of a wide variety of building types, from super high-rise commercial and mixed-use buildings to long-span sports and entertainment arenas, in both steel and concrete. Mr. Poon played a leading role in the structural engineering team for the design of the Taipei 101 in Taiwan. Currently, Mr. Poon is the Principal-in-Charge for the structural design of the 632 meter tall Shanghai Tower, the 590 meter tall 151 Incheon Twin Tower, and the 600 meter tall Ping An Tower in Shenzhen.

Douglas C. Mass³

Douglas Mass is President of Cosentini Associates, a 370-person international consulting engineering firm headquartered in New York. Mr. Mass' 30 year career in mechanical engineering includes hundreds of projects: major mixed-use developments, world-renowned museums and performing arts centers, hotels/resorts, high-rise commercial office buildings, corporate headquarters and educational facilities throughout the United States and abroad. His recent work in the development of fully integrated underfloor delivery of air, power, and voice/data has earned him a national reputation involving design commissions as well as numerous authoring and lecturing invitations.

As the third tower in the trio of supertall buildings at the heart of Shanghai's new Lujiazui Finance and Trade Zone, Shanghai Tower embodies a new prototype for tall buildings. Placed in close proximity to Jin Mao tower and the World Financial Center, the new tower will rise high above the skyline, its curved façade and spiraling form symbolizing the dynamic emergence of modern China.

More than a landmark, the 632-meter, 121-story mixed-use tower offers a sustainable way of living in vertical cities, with a unique mix of restaurants, shops, offices and hotels spaced through the building. It is a super high-rise building wrapped entirely from top to bottom in public spaces and sky gardens. By emphasizing public space where people can linger and offering a variety of community services placed vertically at strategic intervals, Shanghai Tower envisions a new way of inhabiting supertall buildings.

Planning

Spurred by the Chinese economic reforms that began in the 1980s, the Lujiazui district in Shanghai has transformed from farmland to financial center in two decades. This rapid urbanization has required new planning and design strategies to address the need for high-density development on the one hand and "breathing room" on the other. In the design of Shanghai Tower, Gensler has applied the idea of traditional lane houses found in Beijing's hutongs and Shanghai's shikumen, where families live in close-knit dwellings organized around a communal open space. In the case of Shanghai Tower, the neighborhoods are vertical, each with its own "sky garden" to foster interaction and create a sense of community.

In addition to satisfying the Shanghai government's requirement that 33% of the site be reserved as green space, the site's landscape design draws upon historic Chinese precedents of temples, towers and palaces nestled amidst gardens. The park at its base connects architecture to nature, encouraging people's engagement with a variety of outdoor spaces designed for contemplation and simple enjoyment of the landscape. The park will accommodate diverse activities, from large celebrations to intimate conversations. Park paving patterns reflect modern interpretations of Chinese garden details, lending a human scale to the landscape.

Tower Design

By integrating design with technology, Shanghai Tower achieves a new understanding of the supertall building. Gensler's design team anticipated that three important design concepts could reduce typhoon-level wind loads common to Shanghai: the asymmetry of the tower's façade, its tapering shape, and consistently rounded corners. To refine the tower's shape, Gensler worked with partner engineering firms Thornton Tomasetti and RWDI to conduct a series of wind tunnel tests to simulate typhoon-like conditions. Results yielded a structure and shape that reduced the lateral loads to the tower by 24 percent – with each five percent reduction saving about US\$12 million in construction costs.

Shanghai Tower's program is organized into nine vertical zones. Zone 1 is the base-level retail podium of luxury boutiques, high-end dining destinations, cafés and lounges. Zones 2 through 6 are comprised of office floors, each of which acts effectively as a distinct

neighborhood within the tower. Each office zone contains a sky garden to provide identity and community gathering space. A five-star hotel will be located near the top in Zones 7 and 8. The hotel's conference, banquet, and spa facilities share the six-story podium with separate office, housing, and hotel lobbies. The highest of the nine zones houses public amenities: gourmet restaurants and enclosed and open observation decks served by the tallest single-lift elevator in the world. Separate double-decker elevators transport people rapidly between other zones in the tower, and below-grade parking links via walkways to the nearby Jin Mao and World Financial Center towers.

Each of Shanghai Tower's vertical neighborhoods rises from a sky lobby, a light-filled garden atrium that creates a sense of community and supports daily life with a mixed-use program to cater to tenants and visitors. The sky lobbies function much like

...on schedule

“It's a great time to build a building. We can get it done faster and cheaper than during the boom. We're ahead of schedule and under budget.”

Quote from Larry Nichols, Chief Executive of Devon Energy Corp. describes the revival of downtown Oklahoma City, Oklahoma. From the article "Decaying Downtown Becomes Full of Life Again," New York Times, January 27, 2010.

traditional town plazas and squares, bringing people together throughout the day. These civic spaces recall the city's historic open courtyards, which combine indoors and outdoors in a landscaped setting. ↗



The Vertical Garden City: Towards a New Urban Topology



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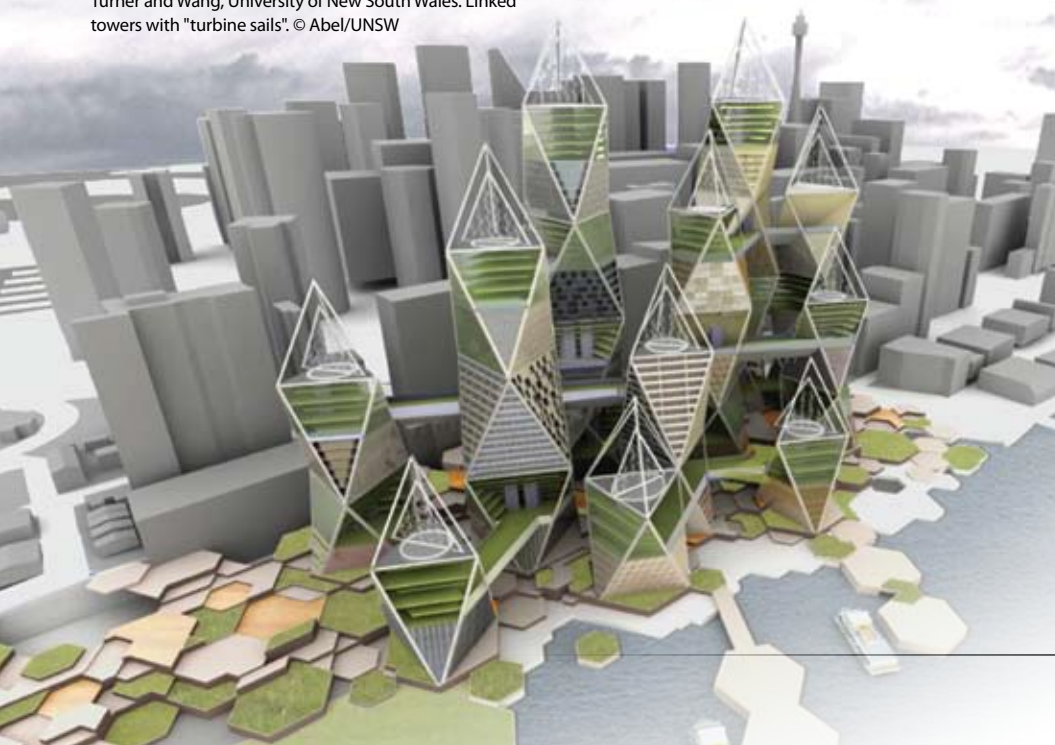
Chris Abel is the author of numerous publications of architectural history, theory and criticism. He has written on leading architects and movements in both the developed and developing world and is a recognized authority on the works of Sir Norman Foster. In 2003 he was co-curator with Foster for an international exhibition at the Royal Academy of Arts in London, *Sky High: Vertical Architecture*, for which he also wrote the book of the same title. He currently teaches at the University of Sydney and the University of New South Wales, where he runs his Vertical Architecture Studio (VAST).

"Understandably, architects have abandoned the flawed urban visions of the past century to focus on the new technologies of production and other more immediate issues. However, having now finally mastered the 'how' of production in the digital age, designers need to refocus on the 'what', and to re-imagine the shape of the modern city to meet the urgent challenges of this century."

The author argues that Ebenezer Howard's original concept of the Garden City has since been stripped of the planner's social agenda and subsequently developed in other ways and at far lower densities than Howard himself intended. The negative consequences of Howard's misinterpreted legacy are evident in the automobile dependent, low-density suburbs of Australia's major cities. Subject to extended droughts, shrinking farmlands and raging

bushfires, the continent is particularly vulnerable to the effects of climate change. In response, most planning authorities in Australia are now implementing strategies of urban consolidation and densification. The author reviews recent innovations in high-rise architecture in search of relevant solutions but finds them still limited by conventional urban typologies. The work of the author's Vertical Architecture Studio © (VAST) is illustrated by selected projects for a prototypical Vertical Garden City produced by students at different universities in Australia and the USA. Examples include designs for integrating food production and power generation within multi-functional complexes. It is suggested that the topological features and qualities of these designs differ significantly from known urban forms and that similar topologies may eventually yield spaces above ground of equivalent character and quality to those found at street level in any great city. In conclusion, the author argues that the future development and success of the Vertical Garden City model ultimately depends on an expansion of the public realm above ground into hitherto wholly private territory – a strategy for which the example of Howard's social agenda may eventually prove to be of more enduring value than the physical plan.

Project for Barangaroo, Sydney, 2009, by Mohd Nor, Turner and Wang, University of New South Wales. Linked towers with "turbine sails". © Abel/UNSW



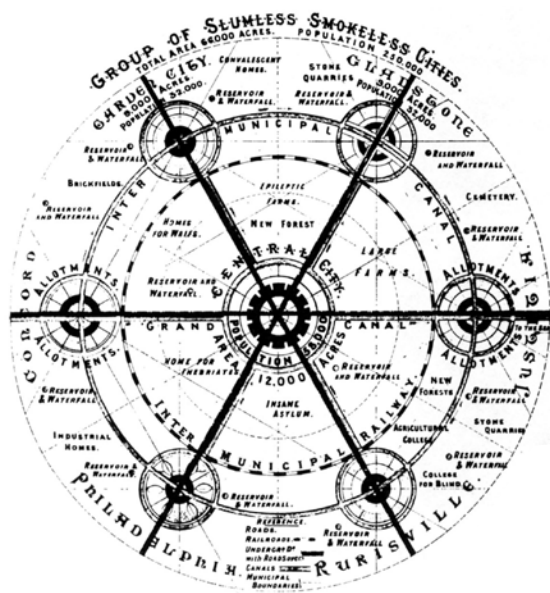


Figure 1. "The Social City", by Ebenezer Howard, 1898. Original diagram. © Fishman, 1982

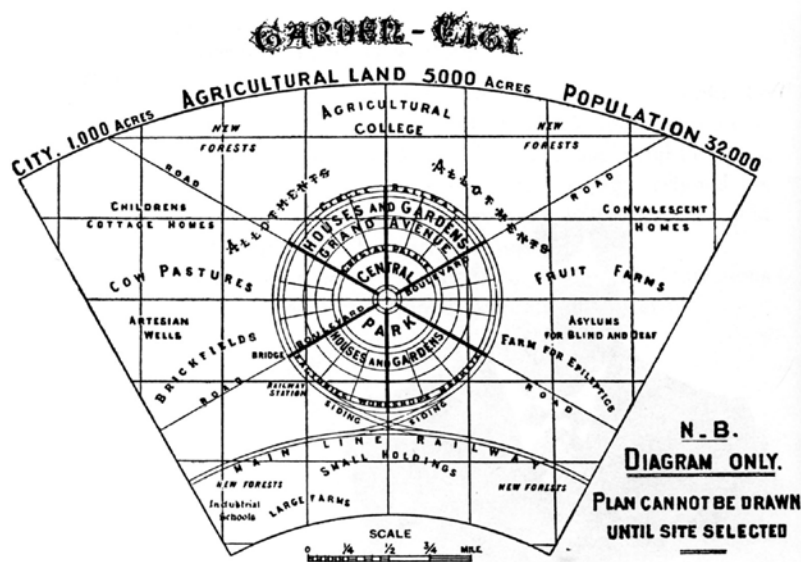


Figure 2. "The Garden City", by Ebenezer Howard, 1902. Segment of plan. © Fishman, 1982

Ebenezer Howard's Legacy

No other concept in architecture or urbanism evokes as powerful a response in the collective imagination as the Garden City (Howard 1898, 1902). Surveying the great figures that have influenced the way we think about urban life and form since the 19th century, the eminent planner Peter Hall (1996) unequivocally nominates Ebenezer Howard as "... the most important single character in this entire tale." However, as Hall explains, despite his fame – or maybe because of it – Howard's ideas have been widely misinterpreted. More than just a physical plan for decentralization, Howard's scheme for relocating industrial production in "Satellite Towns" to be built on cheap farmland well beyond existing urban centers was also a radical blueprint for socio-economic reform, the keynote of which was local management and self-government. As well as owning shares in the land, the increasing value of which would flow back into the community, citizens would build their own homes with capital financed by co-operative societies, unions and similar self-governing bodies, in turn boosting the general economy. As Hall puts it, "... forty years before John Maynard Keynes and Franklin Delano Roosevelt, Howard had arrived at the solution that society could spend its way out of a recession."

It was the famous diagrams of concentric new towns though, which stirred planners' and architects' imaginations, and even these, Hall argues, were mostly misunderstood. The full diagram of Howard's polycentric "Social City" as originally published in the first edition of his work, *Tomorrow: A Peaceful Path to Real Reform*, shows six towns with a population of 32,000 each grouped in circular formation around a Central City of 58,000, all linked together by "inter-municipal" canals, railways and roads across open countryside (see Figure 1). As Howard envisaged it, the whole arrangement of compact new towns and urban core was capable of housing a quarter of a million persons at medium densities. However, the image of the Garden City that imprinted itself upon professional minds was that of an altogether more modest proposal, as pictured in abstracted segments of the plan published in the second and better known title, *Garden Cities of Tomorrow* (see Figure 2). The complete diagram of the polycentric city was generally ignored and was never reproduced again until recently. Howard himself only realized fragments of his scheme at Letchworth and Welwyn Garden Cities near London, the scale and character of which resemble villages more than cities (Fishman 1982).

Presented as a two-dimensional diagram and interpreted ever since by others in its more limited variations as "dormitory" suburbs and semi-autonomous new towns (Choy 1969; Galantay 1975; Hall 1996), the concept of the Garden City was subsequently stripped of Howard's social agenda and developed exclusively as a physical plan. Outdated by the automobile, the networks of railways and canals that were such an important feature of Howard's strategy, suffered the same fate. In their place, Frank Lloyd Wright's own seductive vision of an ultra-low density city criss-crossed by freeways (Fishman 1982; Sergeant 1976), fast became reality, fueled in the post-war years by seemingly endless supplies of cheap land and gasoline. Rejecting low-density models and substituting the communal home for the individual house, Le Corbusier interpreted Howard's vision in his own way, creating a series of projects for a "vertical garden city" comprised of tall buildings set in parkland (Besset 1987). However, Le Corbusier's contrary interpretation failed to stem the general drift towards lower and lower urban densities. What now remains of Howard's legacy has devolved into countless automobile-dependant, repetitive garden suburbs around the world, the growth and maintenance of which are stretching the planet's natural resources to breaking point. ↗

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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