

tall buildings

EDITED BY
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and
BILL PRICE

A STRATEGIC DESIGN GUIDE

2nd
edition

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British Council for Offices (BCO)

The British Council for Offices is the UK's leading member organisation representing the interests of all those who occupy, design, build, own or manage offices in the UK. Since its inception in 1990, the BCO has become the leading forum for the discussion and debate of issues affecting the office sector, providing thought leadership in all issues related to the creation and use of office space. From communicating best practice through the BCO's Guide to Specification, to analysing industry issues such as the recent office-to-residential conversion legislation, the BCO aims to stimulate new thinking on the design, development and occupation of offices across the UK. Alongside an extensive research programme, the BCO runs its annual awards, conference and regular events to recognise the most innovative workplaces in the UK and to bring together the people behind them.

The BCO welcomes this publication as it recognises that offices don't just house companies, they hold people, and so what goes on inside them is paramount to workplace wellbeing.



Council on Tall Buildings and Urban Habitat (CTBUH)

The Council on Tall Buildings and Urban Habitat is the world's leading resource for professionals focused on the inception, design, construction and operation of tall buildings and future cities. Founded in 1969 and headquartered at Chicago's historic Monroe Building, the CTBUH is a not-for-profit organisation with an Asia Headquarters office at Tongji University, Shanghai; a Research Office at Iuav University, Venice, Italy; and a Chicago Research and Academic Office at the Illinois Institute of Technology. CTBUH facilitates the exchange of the latest knowledge available on tall buildings around the world through publications, research, events, working groups, web resources and its extensive network of international representatives. The Council's research department is spearheading the investigation of the next generation of tall buildings by aiding original research on sustainability and key development issues. The Council's free database on tall buildings, The Skyscraper Center, is updated daily with detailed information, images, data and news. The CTBUH also developed the international standards for measuring tall building height and is recognised as the arbiter for bestowing such designations as 'The World's Tallest Building'.

Nigel Clark

Nigel Clark is Technical Director with Hilson Moran and has been involved in the design and construction of buildings for over 38 years. Having graduated from the London South Bank University in 1979, his career started in the public sector, where he was involved in the design of large-scale educational, leisure, residential and court buildings. He joined Hilson Moran in 1988 where he was involved in delivering a number of tall buildings at Canary Wharf, 30 St Mary Axe (SwissRe – also known as The Gherkin) and more recently 20 Fenchurch Street in London. He is currently involved in a number of large commercial, mixed use and regeneration schemes totalling over 600,000 sqm, including 1 Bank Street at Canary Wharf and 100 Bishopsgate in the City of London. In particular, Nigel has considerable experience in the application of advanced software to inform the design process, the application of low and zero carbon and renewable technologies, the energy performance of buildings, as well as façade design solutions to ensure optimum comfort and building performance. He is also an advocate in the potential for BIM to revolutionise the way buildings are designed, constructed and managed. He regularly provides advice on all aspects of the design of buildings in the UK, Europe and the Middle East with an emphasis on tall buildings and environmentally progressive buildings. Nigel has been London Chairman of the Judges for the BCO Awards and has also been a contributor to the recent BCO Guides to Specification and Fit Out.



Bill Price

Bill Price is a director at WSP | Parsons Brinckerhoff and a structural engineer by background. He worked on the multi-award winning Shard from the earliest stages of design development alongside Sellar Property Group, London Borough of Southwark, Renzo Piano Building Workshop, Network Rail and the other designers and stakeholders. In addition, Bill is working on exciting commercial initiatives for Network Rail and Transport for London, a large mixed-use station regeneration project, a major new stadium and new cultural facilities in London and Stratford.



Bill has spoken at numerous conferences and events on the subject of high-rise, sustainability, transportation infrastructure and engineering design. In addition, Bill has travelled extensively in connection with project opportunities in the US, Canada, Europe, Russia, Middle East and North Africa.

Bill has strong links to the BCO and is a supporter of the organisation's activity and contribution to the industry. He has attended its annual conference for over 15 years and has organised its technical building visits in New York, Madrid and, most recently, Chicago.

Our sincere thanks go to all the professionals who have contributed to this publication by providing their expertise and guidance for the benefit of others who are either intrigued by, or involved in, the construction and delivery of tall buildings. It was a concerted desire to bring together a larger number of contributors than the first edition to give as balanced, wide ranging and, hopefully, interesting publication as possible. Such a large list of contributors brought its challenges but we hope the efforts have resulted in a second edition in which everyone will find something of interest and expand their understanding of what makes tall buildings great.

A special acknowledgement must also go to the British Council of Offices and the Council on Tall Buildings and Urban Habitat for their continued support and for commissioning this second edition of *Tall Buildings – A Strategic Design Guide*. A particular acknowledgement must also go to Braden Wyatt for his assistance, support and persistence in collating the various images and obtaining the permissions for their use. His help during the editing of this publication has been invaluable.

To all the contributors for their efforts and willingness to share their expertise so freely and generously and to everyone else who has given permission for material to be included, thank you.

Nigel Clark and Bill Price

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Joseph joined Thornton Tomasetti in 1995 and has more than 30 years' experience designing structures as well as investigating and renovating existing buildings. His credits span a wide spectrum of building types and market sectors. A member of Thornton Tomasetti's board of directors, he is the Managing Principal overseeing the firm's emerging practice areas and operations in Europe, the Middle East, India and Brazil.

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Peter is Chairman of the New London Architecture centre, which first revealed that some 263 tall buildings are currently in the pipeline in London. He is author of *The Saga of Sydney Opera House* – the story of the first modern global icon – and is about to publish a book on the Leadenhall Building designed by Rogers Stirk Harbour + Partners, winner of the City of London Building of the Year 2015 and an important icon in the Square Mile.

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Mat is Head of Savills UK and European commercial property research team. His experience includes work on a variety of topics including inward investment into various office markets, the impact of major infrastructure developments, economic impact analyses, and assessing demand for and master planning major mixed-use developments. He is a regular conference speaker on all aspects of the UK and European commercial property markets, and sits on the board of the BCO.

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In 2005, the British Council for Offices (BCO) published the first edition of *Tall Buildings: A Strategic Design Guide*. Since then there have been significant changes in the world of tall buildings, particularly in the London skyline. Some of the buildings that were in the planning stages in 2005 are now complete, and many more are in both early and advanced stages of development. With this in mind, the time seemed right to produce an update.

In this second edition, the BCO have joined with the Council on Tall Buildings and Urban Habitat (CTBUH) in order to broaden the geographical scope from a predominantly UK focus, to one of international remit. We feel this approach better reflects the reality of the tall building scene today, where many of the tallest and most iconic skyscrapers are located throughout the world's continents.

There are a number of additions and improvements to this edition of *Tall Buildings*. Thought pieces by key industry experts open the book with some intriguing insights into where we are today and where we should be focussing our attention in the future with regard to the vertical urban landscape. The addition of interviews to Chapter 2, *Occupier Perspectives*, also provides an interesting, first-hand account of why organisations choose to occupy tall buildings in the first place.

A decision was made to expand and break up the chapters on design aims and development, to reflect better the wide range of specialists and expertise needed to deliver tall buildings – from design and engineering to construction and management. As part of this change, a brand-new chapter on BIM brings the book up to date with modern practice and technology. This fills an important gap in the book's treatment of design strategy, as the success of tall buildings relies heavily on a high degree of coordination and efficient information exchange.

Chapter 9, *End Of Life Of A Tall Building*, expands on an increasingly important topic, the sustainability agenda, amid efforts to move toward circular economy principles and long-term planning to protect skylines and resources for future generations. Finally, in this edition we decided to end by looking to the future, with Chapter 10, *The Next Generation*, considering the likely drivers of continued development and guidelines for the next generation of tall buildings.

As with the previous edition, this publication is not an in-depth guide to producing tall buildings, but rather a 'road map' of key aspects to consider in their generation and evaluation. It has been produced by professionals with specialist knowledge in the fields covered and we are very grateful to the editors, Nigel Clark and Bill Price, for sharing their professional expertise, skills and, most particularly, their time with us. We are also grateful to the large number of contributors who shared their own valuable knowledge and experience under the leadership of Nigel and Bill.

We hope this second edition will contribute in some small way towards the creation of even better tall buildings for future generations to use and, more importantly, enjoy.

Richard Kauntze
British Council for Offices

Dr Antony Wood
Council on Tall Buildings and Urban Habitat



← The Shard, London

Introduction

The BCO first published a tall buildings design guide in 2005. At that time the London skyline was starting to change significantly after a period of relative stability since the 1970s. A number of tall buildings were also in the early stages of design and planning process. The 2005 guide showcased many of the proposals for London and discussed particular attributes of these buildings, together with the effects they would have on the City of London, the occupiers and the public.

In the period since 2005 many of the showcased buildings have been constructed and the skyline of London changed further. There has also been time for many additional tall buildings (mostly residential) to be planned and constructed. The worst UK recession since the 1930s commenced in 2008 and, at a global level, more people were living in cities than in traditional rural locations.

With the continuing demand for tall buildings and the appetite for change London has embraced, the BCO felt that the 2005 guide needed refreshing and updating. This second edition of the guide covers a wider range of content than the first edition and is comprehensively revised.

To set the scene, it is useful to understand five emerging trends and these are set out below. As a precursor, however, it is worth discussing what constitutes 'tall'. It has been suggested that 'tallness' could be about height relative to context, or perhaps proportion. In this book the word 'slender' appears and that is essentially about proportion. We are concerned here with modern cities and buildings, so context and relative scale becomes secondary.

In New York, tall is frequently considered to be 50 storeys and for an office this could be 200m. In the UK, 30 storeys, or around 100m, is more likely to attract that title. Two other titles have appeared in recent times, including 'supertall' for a building over 300m and 'megatall' for over 600m. All these kinds of tall buildings are mentioned in the book and as of April 2016 there were 101 supertall and three megatall buildings completed and occupied globally.

Contributors

Nigel Clark
Bill Price
Dr Antony Wood



Perspectives on Building Tall

 Future skyline of
the City of London

Any proposal for a tall building usually stirs up a range of strong emotions amongst public and private stakeholders, as well as within the development, design and construction community. At the early inception and concept stages interest tends to be focused on wider considerations than just the appearance and purpose of the building. In a series of thought pieces, this chapter highlights the issues around these sometimes controversial, ambitious, risky and expensive endeavours.

Contributors

Dr Antony Wood
Paul Scott
Peter Murray

Why Build Tall? | Dr Antony Wood

Drivers for building tall, such as land price, the desire for a greater return on financial investment, or the desire for an icon to 'brand' or promote a corporation or a city remain consistent. However, the need for denser cities as a response to climate change and more sustainable patterns of life has become an increasingly important driver in recent years.

Land prices and return on investment Historically, the higher cost of land typical of city centres has always been a motivating factor for the construction of tall buildings. The higher land cost drives a need for the developer to realise a greater return on investment by creating more floor area for sale or rent. It needs to be noted that the greater return on investment through providing more floor area is obviously offset by the higher construction costs required of high-performing materials and systems at height, such that eventually a 'height threshold' of return vs cost will be reached.

Corporate branding and the global skyline Whereas tall buildings have been used throughout their history as marketing tools to portray the vitality of a corporation, such as SwissRe (also known as The Gherkin) in London, now they are increasingly portraying the vitality of a city or country on a competitive world stage. This is reflected in the titles of the buildings themselves – previously endowed with names such as Woolworth, Sears or Petronas, they are now more likely to be named TAIPEI 101, Chicago Spire or Shanghai Tower. The buildings are being used to brand a city, since many cities, especially in developing countries, believe it necessary to have a signature skyline to be considered successful and thriving.

Rapid urbanisation and climate change There are perhaps more compelling reasons for the increase in tall buildings than just corporate or urban branding. It is believed that there are now almost 200,000 people urbanising on this planet every day (United Nations statistics), requiring a new city of about one million inhabitants every week to cope with this global migration from rural to urban. In some places, this is an organic transition driven by the economic opportunities afforded by cities. In others, it is a combination of organic and political forces. In China, both existing cities and almost entirely new 'overnight' cities are mushrooming, as part of an official policy of urbanisation, changing the economy from one powered by manufacturing and agriculture to one powered by consumption. China now has more than 150 cities of one million people or more, and plans to move 250 million people into cities by 2020.

The classic model of a dense downtown working core with a massive, ever-expanding low-rise suburban periphery is an unsustainable one, due to the increased infrastructure needed (roads, power, lighting, waste handling, etc.), as well as the energy expenditure and carbon-emission implications of the home-work commute.

Cities need to become denser to create more sustainable patterns of life, reducing the horizontal spread of infrastructure networks and to be more efficient in land use, partly for retention of 'natural' land for agricultural purposes.

Although tall buildings are not the only solution to achieving high density in all cities, they can be part of the solutions for some cities. This urban-density driver, coupled with the city-symbolism/ iconic driver, has been influential in the escalation of the number of tall buildings being built and planned in developing countries.

Magnet Cities | Paul Scott

Why build tall? The explosive demand for tall buildings in the world's 'magnet' cities (see Figures 1.1, 1.2 and 1.3) reflects forecasts that, by 2050, 80% of the world's population will be living in cities. London's population is expected to increase from 8.5 million in 2015 to 11 million by 2050. In New York, the population will grow from 8.2 million to 9 million by 2040. And Shanghai's residents will surge from 24 million to 50 million by 2050. China's strategic urban plan is to create 100 new cities, each containing at least one million people [Hoorweg and Pope, 2014].

↓ **Figure 1.1:**
Shanghai's skyline



London and New York remain the ultimate examples of cities where the demand for residential and tall commercial/corporate towers are closely linked: these two cities are still the world's key financial reactor-cores, though Singapore and Shanghai are expected to join them by 2025. London and New York are also the most desirable cities to live in, particularly for the super-rich, or the merely wealthy.

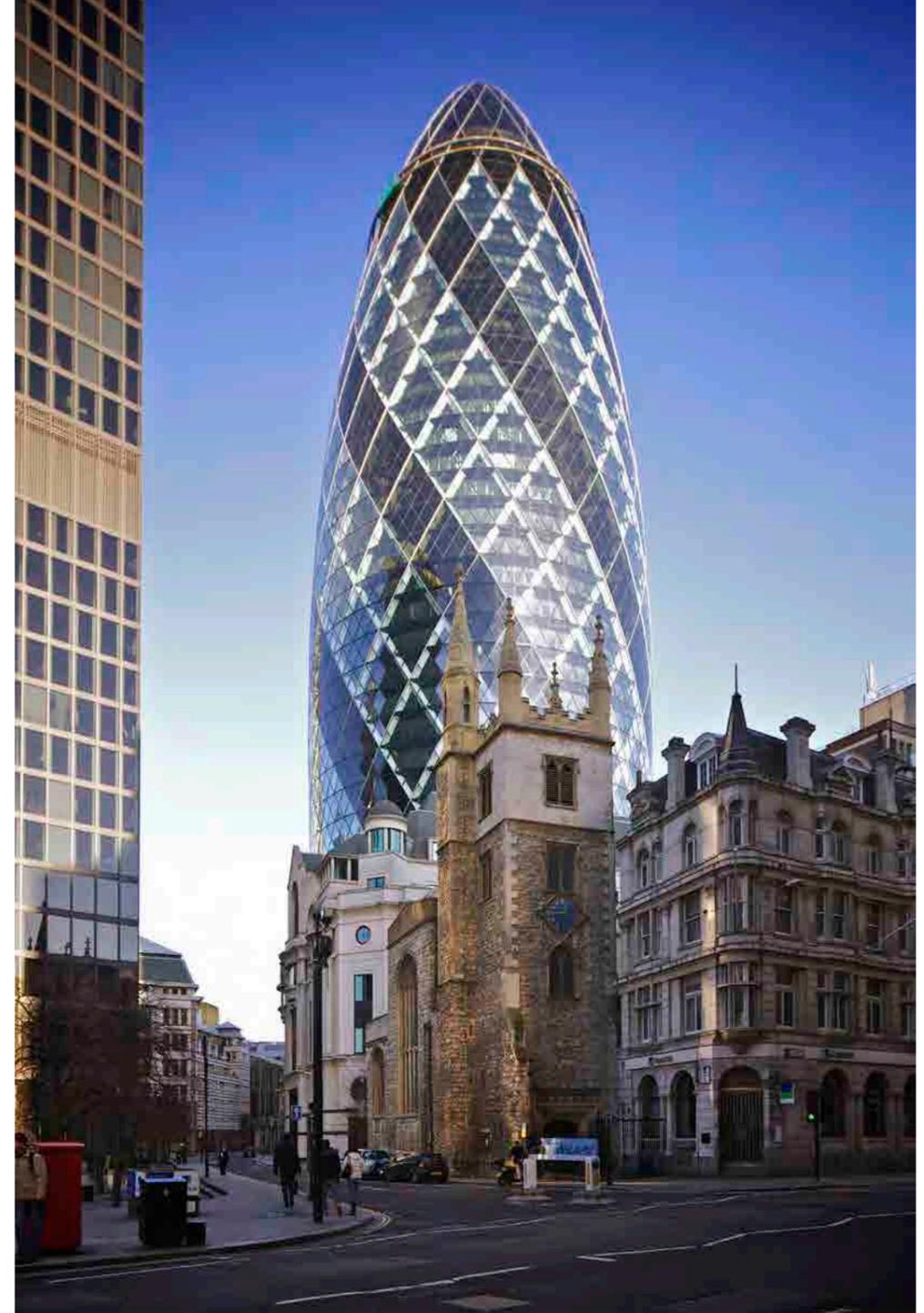
↓ **Figure 1.2:**
London's skyline



Do We Need Icons? | Peter Murray

When New London Architecture (NLA) published its research findings in 2014 which showed that over 250 new towers were either under construction or in the development pipeline in the capital, the *Evening Standard* likened the results to 'Dubai-on-Thames', which presumably reflected the author's dislike of the rich mix of towers in the Emirate, made up of styles and forms that merge into a massive, muddled wall of steel, glass and concrete. Many of these towers are designed to be icons with innovative shapes and expressive structures, but because they are set in the context of others also fighting for attention, they lose their iconic status. The real icon of Dubai of course is the Burj Khalifa (see Figure 1.7), not just because it is tall but because it is tall in relation to the rest of the city. It stands out and has become a key part of the Dubai brand.

→ **Figure 1.7:**
The Burj Khalifa,
Dubai



← **Figure 1.8:**
30 St Mary Axe,
London

Some suggest that iconic architecture is a new phenomenon, driven by modern marketing and branding, but ancient civilisations certainly understood the impact of large structures. By locating the Acropolis on top of a hill, the Greeks ensured it commanded the city beneath and became a powerful and universal advertisement for Athenian politics and culture. Equally, St Paul's Cathedral towered over a city ravaged by the 1666 Great Fire as a symbol of London's resurgence – and the protection of its views and its role as an icon – is key to controlling development to this day. Indeed, the Mayor's London View Management Framework and the St Paul's Heights legislation recognises that once a building has to start jostling with others for attention, it can lose that iconic status.

There is no doubt that the emergence of the elliptical form of 30 St Mary Axe on the London skyline had a substantial impact on international attitudes to London as a city, particularly in the Far East where the UK's image has always struggled to be separated from the Queen, corgis and half-timbered cottages (see Figure 1.8). It became an important image in the marketing of the Olympics both before and after the bid. It told the world that London was a modern city and proud of it.



Occupier Perspectives



← *Shanghai, China*

There has always been a human fascination in building tall, so where more natural to start in our efforts to design better tall buildings than with the occupiers who live and work in our current attempts and understand what does – and most importantly what does not – work for them? Occupier research and feedback provides a valuable insight into the most important aspects from the occupier’s perspective.

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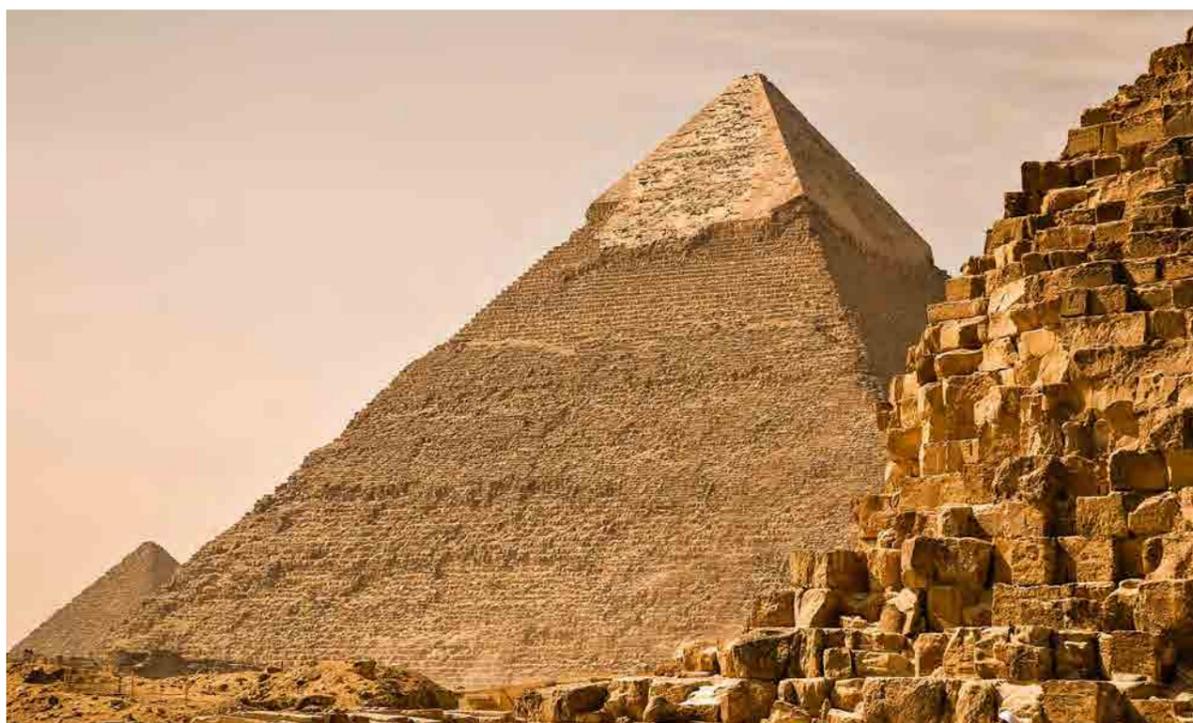
The Fascination with Building Tall

Mat Oakley

The question of why office occupiers like tower space is a surprisingly difficult one to answer. One of the reasons is perhaps the decision has more to do with human nature than any particular economic or business rationale. Indeed, some psychologists have argued that the desire to be high stems from some atavistic desire in humans as predators to be able to see their prey from afar!

Whatever the driving force behind our need or enjoyment of being up high, it is clear that this is by no means a recent phenomenon, as we do have one example that still remains from ancient history – the Great Pyramid of Giza (see Figure 2.1). The fact that this structure, equivalent in height to a modern 40-storey office building, still remains after 4,000 years is impressive alone, but when you consider that the difference in height between the opposite corners of its foundations – which are more than 320m apart – is only 2cm, you have to marvel at the standard of the ancient Egyptian specification.

↓ **Figure 2.1:**
Great Pyramid
of Giza, Egypt



Jumping ahead around 3,900 years takes us to the evolution of the modern residential and office tower. Arguably, many of the residential towers of the 20th century have been demolished and condemned as a failed social experiment in moving the slums to the skies, whilst the office towers have stood the test of time much better. The guiding principle behind those first successful 20th-century office towers in Manhattan and Chicago is still the most true and easy to understand why occupiers like towers today: they are a practical solution to lack of developable land, and consequently very high land values. Indeed, the world's major clusters of towers still exist in locations such as Hong Kong, Tokyo and Manhattan, where land supply is naturally constrained by the local geography. Office occupiers that want or need to be in these markets arguably have little choice other than to consider an office tower; their only flexibility is around the height, specification and location of the tower that they end up occupying.

Why Locate in a Tall Building?

Mat Oakley

Having identified that occupiers choose towers in areas where the land supply is limited, we will now consider some reasons why occupiers choose tall buildings where they have more choices. This takes us towards more human aspects such as people, profile and status. Why does an occupier choose high-rise over low-rise in a relatively unconstrained city like London, Chicago or Shanghai? To get to the heart of this question we have to examine why occupiers choose one location or building over another. Most surveys of CEOs and property decision-makers point to the same important factors, namely location and availability of staff. In cities such as Shanghai, Chicago and London, the availability of staff is less of an issue but location within the city is important. Most surveys, including Savills' regular 'What Occupiers Want', point to rent being only the fourth or fifth most important factor in building selection. In the context of tower buildings, where the rents achieved on the top 25% of the building are almost always within 5% of the top rent being achieved in that market at that time, a flexible attitude to the rent bill is a fairly fundamental attribute for all occupiers considering high- over low-rise, but the first priority is to see if the leasing terms are within the organisation's budget. However, neither of those two key factors implicitly supports the decision to take office space in a high-rise office building. If we accept that really both factors of the CEOs are about the same thing (i.e. attraction and retention of staff), maybe the attractiveness of office space in tall buildings is being driven by the employees' preference for it?

Do staff Like tall buildings? The BCO's 2013 'What Workers Want' report identified the top 15 most important factors to workers, and while tall buildings can deliver all of those, none were specifically factors that could only be delivered in a tall building.

- 1 Improve comfort (temperature, light, noise, smell)
- 2 Kitchen facilities
- 3 Improve security
- 4 Improve WiFi quality
- 5 Provide funky fit-out
- 6 More/better meeting rooms
- 7 Better break-out areas/increased provision
- 8 Improve/advertise 'green' policies
- 9 On-site café
- 10 Enhance/have more colour
- 11 Green space/roof terrace
- 12 Office art/greenery
- 13 Better/more shower and changing facilities
- 14 Better internal workplace flexibility
- 15 Bicycle storage

However, some of the factors, such as security, roof terraces, on-site cafes, natural light and general comfort, might actually be easier for the developer to offer in a high-rise than a low-rise building, purely as a function of the higher rent on tower space. Indeed, given that light is probably the most commonly complained about factor in pre- and post-occupation surveys, the height and generally smaller floor plate of a high-rise will often mean that more staff are close to a window than in an equivalent low-rise building (see Figure 2.2). Supporting this theory is Markel International's feedback that the quality of the light in its office space was a deciding factor.

While surveys and research are obviously the first call for a researcher, the question of why people like towers is probably best answered with the statement 'because they're high!' Many people like

Tall buildings have much greater permanence than their low-rise counterparts. The changes to a skyline that such buildings create can be strong symbols of growth and a dynamic city, but where tall buildings are poorly positioned or lacking in quality, impacts can be negative and equally long lasting. They will impact the skyline for many years to come, perhaps arguably forever, so their quality and context is fundamental to their success and acceptance.

There is little doubt that the quality of our tall buildings has increased over time, but even more important is the realisation that their contribution to the urban landscape and the public realm is what really makes a tall building successful. The creation of public space, both around and within our tall buildings, allows everyone to enjoy them – not just the select few who work or live within them. Many of the buildings which have been chosen to illustrate this book are testament to this.

The preceding chapters have shown that thinking and caring about the scale and impact of high rise is critical from the very earliest stages of a project. The care and attention from the many stakeholders who give permission, fund, design, construct and occupy tall buildings, and absorb them into the community, is crucial to creating a successful high rise. In addition, we hope to have given a glimpse into the complexity, ingenuity and magnitude of the detail necessary to realise the product.

Creating a building is never an easy task and setting the building in context is always a challenge. Delivering tall buildings has become more complex over time, requiring a wide range of expertise within a strict framework. With the current economic pressures, the drive for efficiency and reduced construction costs requires innovation and challenges previous standards. New materials and construction techniques are continually being devised, allowing faster, safer and more cost effective tall buildings in the future.

In the 2002 book, *Cradle to Cradle*, by William McDonough and Michael Braungart, the authors argue that products should be designed for continuous renewal or should avoid being down cycled into low grade use. This second edition of *Tall Buildings* considers a variety of visions of the future where we recognise the longevity of the building and imagine future use, thus recycling to retain value. The evolution of high rise is a continuous process of adaptation, comparable to natural world responses to environmental, socioeconomic and commercial constraints.

The need and desire for tall buildings in order to cope with the densification of our cities, and the human desire to build taller and taller, will continue over time. The accolade of being the tallest building in the world still captures our imagination and will drive us higher and higher well into the future.

All these considerations drove the structure for this new edition, as well as the desire to cover such a wide range of intertwined subjects, all of which are fundamental to the creation of successful tall buildings for the enjoyment of everyone. If this publication helps in some small way to deliver one single better tall building through the knowledge shared by the contributors, then the effort will have been worthwhile.

Nigel Clark and Bill Price