

QUARTERLY REVIEW

TALL BUILDINGS

Issue 3

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Tight Spaces

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Queensbridge Tower

The Spire London

REACHING FOR THE SKY

Reaching for the Sky



Front cover image: Australia 108, Melbourne
Inside cover image: The Spire, London

From the time of the earliest civilizations, there has been the desire to build the biggest, the tallest of structures. Visions of grandeur, be they in the eyes of kings or corporate giants, have inspired not only architects but also the engineers charged with realizing those visions.

“When Robert Bird first started in Brisbane in 1982, a tall building would be 30 storeys,” recalls Robert Bird Group deputy chairman Grant Weir. “Today, it’s more like 50 storeys and up.” That shift in scale has elevated RBG into an exclusive league of structural engineers with the experience, technology and expertise to engineer some of the worlds tallest, best-known modern buildings.

Reaching new heights presents new challenges and new standards of quality and safety. Achieving bold iconic designs calls for intense scrutiny of details, aided by modern technology’s ability to virtually build and test these mega-structures through building information modelling.

“The higher you go, the more you have to deal with some age-old issues, one of the most significant being the ability to transport workers and materials during construction,” notes Simon Cloherty, director of UK Buildings at RBG. The cables used for that transport are still bound by the laws of gravity; the longer they are, the heavier they get. Currently, the maximum height for a “sky lobby” (i.e. lift terminal platform) is 35 storeys, at which point you need to transfer to another lift.

Axial shortening – most commonly, the shrinkage of vertical concrete support columns due to drying – becomes a much bigger issue over 30 storeys as well. The solutions can be complex. Regardless, the attention to detail and accuracy is critically important to ensure the integrity of the other structural elements.

Let’s not forget that people are intended to occupy these structures. Super-tall buildings have to be able to sway in order to be safe. As the earlier tallest structures revealed, that can create the physical discomfort of motion sickness. “Today,” says Weir, “the right engineering removes that problem; the building is still moving as it should, but you won’t notice it.” What some people will notice, though, is the physical detachment from the landscape that can come from living and working 80 storeys above the earth. Not everyone is comfortable with that degree of separation. Another concern of workers and residents is safety, especially during hurricanes such as those reported in the news in the past year. In many cities, the tall modern buildings and their ability to “bend but not break” make them safer from not only wind, but also deadly storm surges. “On these projects, there is always lot of interaction between the wind engineers and the structural engineers,” says Cloherty.

So how high can we now go? In almost all cases, the biggest limitation is not structural, but economic. An extremely tall building can take 10 years to complete, even when actual construction might take only four. The obstacles are many and varied. Months can be devoted negotiating matters such as height restrictions due to proximity of a nearby airport, building codes that may be out-of-step with today’s materials and technology, and the logistics of supply delivery to highly congested urban locations.

This edition of the RBG Quarterly Review touches on a few examples of recent accomplishments in tall building design and engineering. We are proud to be associated with outstanding developers and architects from throughout the world.

For more information on RBG’s tall building portfolio and our world-class capabilities, please contact Simon Cloherty in our Sydney offices on +61 (0) - 7 3319 2777.

Making the Most of Tight Spaces

Advancements in tall building design, engineering and construction have benefitted other forms of urban development as well. The key benefit has been the increase in the “slenderness ratio.” In older buildings that ratio might be something like eight times higher than the width.

Some buildings today have reached a ratio of 20:1. For developers of narrow properties, especially those in older urban centres, this can mean a greater return on investment over the long term.

Other advancements have also meant less disturbance to neighbouring residents, less threat of damage to any historic structures, and faster construction which reduces disruption to traffic flow and other services.

Phoenix, Melbourne

The super slim Phoenix Apartments has an aspect ratio of 1:13, making it extraordinarily skinny. Although not considered a super tall structure, Phoenix was the Asia & Australasia Finalist for the 2015 CTBUH Best Tall Building Awards. The tower is situated on a small site in Melbourne’s central business district of just 160 square metres, with a frontage under seven metres and a depth of approximately 24 metres. The 28-level tower comprise 28 apartments, one apartment per level. The project also incorporates a 13-level multistorey automated car stacker/lift (all above ground) housing 26 cars.

RBG provided structural design services for this unique project.

Client: Equiset Construction
Architect: Fender Katsalidis Architects





Attaining Higher Expectations

With all projects, Robert Bird Group focuses on delivering holistic, value-based solutions that deliver the ideal balance between cost, time, risk and other project criteria.

Early Involvement and Conceptual Work

The earlier RBG is involved with the entire project team, the more value we can bring by thoroughly understanding the project and evaluating all of its aspects. This enables us to suggest concepts that can inform decisions.

Value Management

At key points in the design process, RBG will prepare option studies on different structural and civil solutions.

Design and Documentation

Drawing upon the experience and knowledge throughout the Group, we translate our design scheme into working 3D models, followed by ongoing data exchange and detailed design updates.

Advanced Structural Analysis

Robert Bird Group has the analytical capacity to develop active and passive control systems to address complex structural behaviour, including high-rise buildings subjected to unstable ground conditions, seismic occurrences and extreme weather conditions.

Building Information Modelling

Our 3D models accelerate internal design, resulting in more rapid procurement and construction programmes.

Additional Services for Construction

Specific services at the construction phase include RBG's independent monitoring and design of temporary works.



A black and white photograph of a man with short, dark hair and a light beard, wearing a white button-down shirt. He is looking down at a document he is holding in his hands. The background is blurred, showing what appears to be a modern building or office interior with large windows and structural elements.

At Work

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ICD Brookfield (Dubai)

Queensbridge Tower

The Spire, London

Tallest tower in Kuala Lumpur

Fifth tallest in the world

RBG, in association with Leslie E. Robertson & Associates, is the structural consultant on the 118-storey headquarters for PNB in Kuala Lumpur. The project features 80 levels of office space topped with a hotel and observation level. This predominantly steel-framed structure is reinforced with a "concrete mega-structure with mega-columns" to provide lateral stability.

PNB 118

Kuala Lumpur

Client: PNB
Architect: Fender Katsalidis



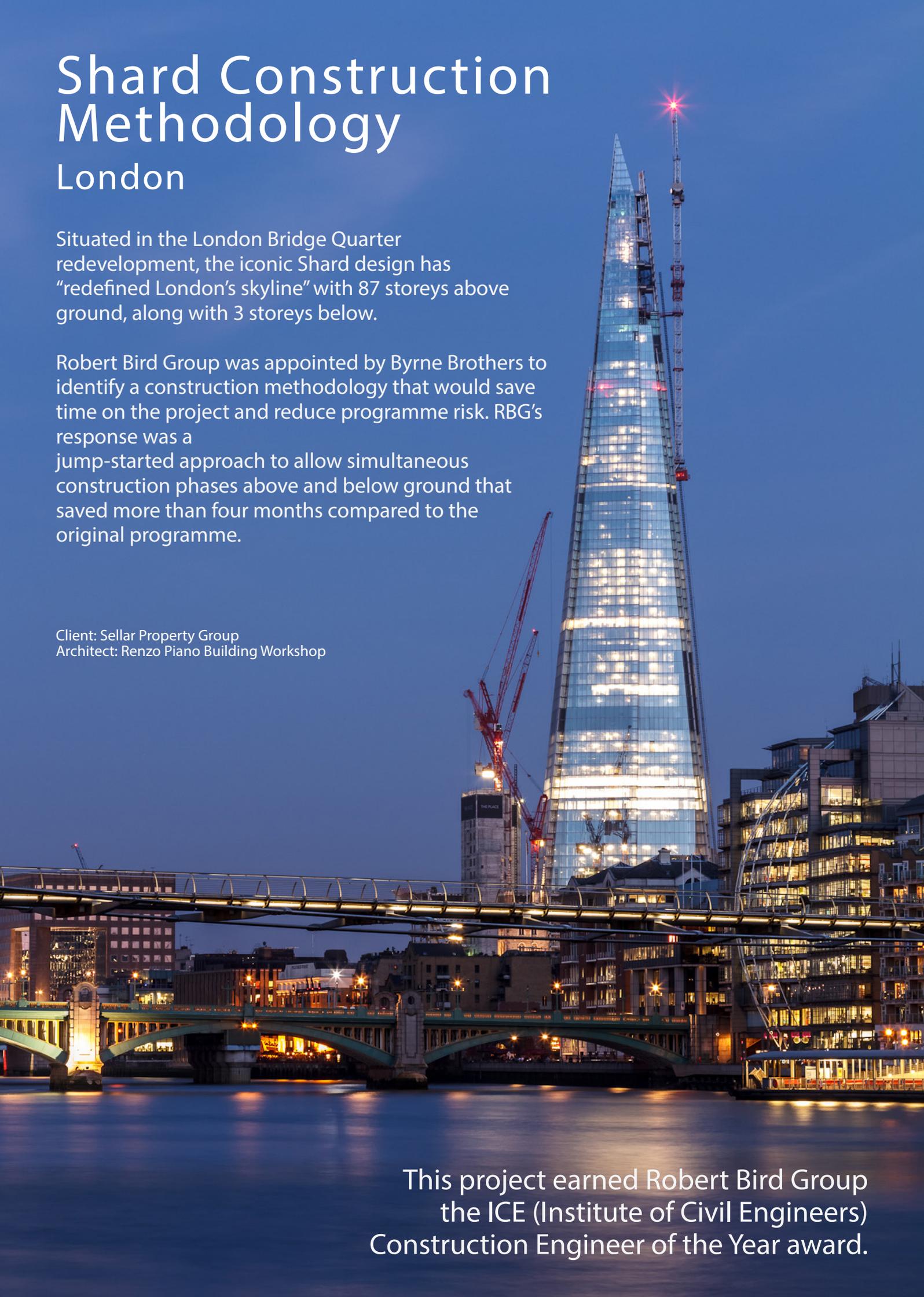
Shard Construction Methodology

London

Situated in the London Bridge Quarter redevelopment, the iconic Shard design has “redefined London’s skyline” with 87 storeys above ground, along with 3 storeys below.

Robert Bird Group was appointed by Byrne Brothers to identify a construction methodology that would save time on the project and reduce programme risk. RBG’s response was a jump-started approach to allow simultaneous construction phases above and below ground that saved more than four months compared to the original programme.

Client: Sellar Property Group
Architect: Renzo Piano Building Workshop



This project earned Robert Bird Group the ICE (Institute of Civil Engineers) Construction Engineer of the Year award.

Australia 108

Melbourne

Client: World Class Land
Architect: Fender Katsalidis



There are more than 1000 apartments in Australia 108, which once completed, will be the tallest building in the Southern Hemisphere. The 320m tall tower offers residents an iconic address in the heart of Melbourne's arts, dining and entertainment precinct. The complex "starburst" construction will house amenity areas which cantilever over eight metres.

RBG is providing structural, civil and construction design services, as well as visualisation services.




Robert
Bird
Group

Crown Sydney

Client: Crown Resorts Limited
Architect: Wilkinson Eyre

This is high living at its finest, with luxury residential apartments and a six-star 350-room hotel, restaurants and shops, a members-only casino, and panoramic views of the Opera House and Sydney Harbour Bridge. To maximize resident access to those views, the architecture is a twisting form with perimeter columns following the curvature of the façade – necessitating sophisticated structural engineering design and modelling. Another significant challenge was the site geology; the tower is approximately 25 metres from the waterfront.



ICD Brookfield Place Dubai

Client: World Class Land
Architect: Foster + Partners



Construction is under way on Dubai's newest addition to its skyline – a premium grade office 54-storey development with over a million square feet of leasable area including 980,000 square feet of column-free work space complemented by more than 140,000 square feet of retail, restaurant and other amenities.

RBG is working closely with the design consultancy and project management teams to ensure an efficient and effective structural solution is delivered to the client which will embody the vision of the project.

Queensbridge Tower Melbourne

Client: Crown Resorts Ltd & Schiavello (Vic) Pty Ltd
Architect: WEA Architects & Architectus



When completed, this 90-storey residential/hotel structure in Melbourne will be not only the tallest building in Australia, but also one of the biggest single-building projects in the country with more than 300,000 square metres of floor area. The tower footprint changes to suit the elegant wave and rippling affect created by the faced and the buildings form.

RBG is providing structural design services.





Spire London

Client: Greenland Hertsmere London Ltd
Architect: HOK

Located in West India Quay near Canary Wharf, Spire London will become western Europe's tallest residential tower with 860 apartments on 67 levels. Project completion is slated for 2020.

Robert Bird Group was appointed to undertake full structural, civil and geotechnical engineering services.

The building straddles a Crossrail tunnel, requiring a complex soil structure interaction analysis of the piled raft transfer system, with large diameter piles up to 70m long. The buildings' three pronged form created an inherent behavioural tendency towards a torsional dynamic response in the wind, and required careful proportioning of the lateral system stiffness to move the torsional response into the less dominant third mode.



The relentless Pursuit of Engineering Excellence

For more information on renewable energy and the unique capabilities of Robert Bird Group, please contact your nearest RBG office.

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Robert Bird Group is a global structural and civil engineering firm with over 500 staff in Australia, the United Kingdom, the United Arab Emirates and South East Asia. We create quantifiable value for our clients through advanced engineering and comprehensive planning.

Established in 1982, we have fostered long-term relationships with our public and private sector clients that have led to a diverse portfolio of industry and government projects. We apply our specialist engineering expertise throughout the built environment including high-rise and waterfront developments, retail projects, public buildings, heritage-listed properties, and major projects for urban regeneration, health, education, sports, transportation infrastructure, power and renewable energy.

Our Group is committed to environmentally sustainable design as demonstrated by our portfolio of accredited projects including six-star Green Star rated buildings in Australia, BREEAM rated projects in the UK, and LEED Gold and Platinum projects.

RBG values design thinking that fully addresses complex challenges. Inspired by our involvement in prestigious projects and our relentless pursuit of engineering excellence, our professional project-specific teams are delivering superior results for our clients worldwide.

The Robert Bird Group Quarterly Review is published in the hope of stimulating and contributing to the important discussions about engineering and its impact throughout our world. We welcome your suggestions, comments and inquiries, please contact Lilli Fender lilli.fender@robertbird.com, or for any project related inquiries please contact Simon Cloherty simon.cloherty@robertbird.com



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