

# WINDOWS TO THE WORLD

ONE TAIKOO PLACE





# PLANNING



PLANNING

MANAGEMENT



MANAGEMENT

'CAN DO' SPIRIT



'CAN DO' SPIRIT

“ Good planning, good management and  
'can do' spirit.  
This is how the team met the target. ”



GAMMON



1993



Devon House

1994



Dorset House

1994



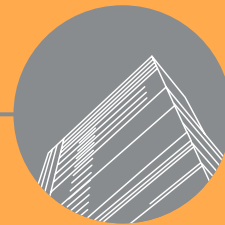
PCCW Tower

1998



Lincoln House

1999



Oxford House

2008



One Island East



## BUILDING HISTORY

Back in the 70s, Swire Properties identified new potential for its land at Taikoo Dockyard, a change of function that would herald the beginning of a new era for Quarry Bay. It would also mark the beginning of what has become a long and successful partnership between Swire and Gammon Construction Limited.

The partnership has its roots in Swire's decision to redevelop the land once occupied by the historic docks and wharves into a modern and well-designed private housing estate.

Called Taikoo Shing, the complex was enormous and included 61 residential towers with almost 13,000 apartments on a 3.5 hectare site. Much of the construction work on the development was awarded to Gammon.

Since then, Gammon has continued to work closely with Swire on projects throughout Hong Kong and even as far afield as Beijing, but nowhere is the success of their partnership more apparent than at Taikoo Place. A visionary urban regeneration project, Swire's Taikoo Place has seen Quarry Bay's old sugar refinery transformed into a hub for multinational businesses, with state-of-the-art office space and stylish restaurants and bars linked by a network of elevated pedestrian walkways. The majority of the construction work has been overseen by Gammon.

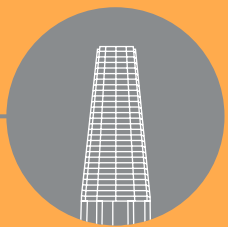
Completing the first of Taikoo Place's office towers, Devon House, in 1993, Gammon went on to deliver Dorset House, PCCW Tower, Lincoln House, Oxford House and, in 2008, One Island East, a 68-storey triple Grade-A office

tower that was one of the largest and most significant award-winning projects built in Hong Kong up to that time.

With the completion of One Taikoo Place commercial tower in September 2018, Gammon could proudly claim responsibility for constructing seven of the nine office towers that currently make up the Taikoo Place business hub.

To date, Gammon has delivered almost half a million square metres of office space in Taikoo Place and played a key role in providing Eastern District with a modern and well-connected business precinct to rival that of Central Hong Kong.

2018



One Taikoo Place



“ With the completion of One Taikoo Place, Gammon could proudly claim responsibility for constructing seven of the nine office towers that currently make up the Taikoo Place business hub. ”

## CHANGING THE OFFICE LANDSCAPE

One Taikoo Place is not simply a triple Grade-A office tower. A key element in Swire Properties \$15 billion Taikoo Place redevelopment project, it embodies the concepts of physical and social connectivity so important to the ethos of the entire business hub. It also represents the possibilities for positive change to the environments we work in, as well as to the way buildings are constructed.

A 41-storey office tower atop a five-storey podium and two-storey basement carpark, the structure, in addition to meeting BEAM and LEED sustainability criteria, was designed to address the seven concepts of the WELL building standard that focuses on occupant health and productivity: air, water, nourishment, light, fitness, comfort and mind.

Each floor offers occupants panoramic views of Victoria Harbour and an abundance of natural light through expansive glass walls, while an extensive open green space is provided for the community's enjoyment and to reduce the urban heat island effect. Two elevated air-conditioned walkways link it to the thriving interconnected campus of office buildings that make up Taikoo Place.

The office tower was built to the highest sustainability standards and includes a number of cutting-edge passive and active energy-saving design features to reduce energy demand and consumption during operation. It was also built in the spirit of collaboration, with Gammon leading its value chain to adopt modern methods of construction that are safer and leaner, methods that included design for manufacture and assembly (DfMA) and virtual planning.

It was built with the support of Gammon's considerable in-house expertise who provided prize-winning innovative digital solutions for more efficient planning and management, through to prize-winning mechanical solutions.

And it was built with the use of building information modelling (BIM), 3D scanning and printing that underpinned the precision installation required for much of the works.



One Taikoo Place has achieved Provisional Platinum for BEAM Plus New Buildings Version 1.2 green building standards and is Pre-Certified Platinum for LEED BD+C: Core and Shell Version 2009 and Pre-Certified to WELL Platinum level.



# WORLD-CLASS CONSTRUCTION







Construction  
Industry Council  
Sustainable Construction  
Award 2018

★ ★ ★  
**EXCELLENCE**

Construction Manager

## EARLY INVOLVEMENT

Long before the tendering phase for One Taikoo Place had even begun, Gammon was engaged by Swire to carry out an independent buildability study. Led by Sammy Lai, who would eventually go on to run the project, the study allowed Gammon to suggest a number of ideas that promoted sustainable construction, in keeping with Swire's vision for the area.

"Swire has a very long-term vision about developing this whole district," says Lai. "They were willing to try new systems and new approaches and are attuned to innovation so they were very receptive to our recommendations in the study, particularly as there was a sustainability benefit."

It was this focus on sustainability that would eventually garner Lai the prestigious Excellent accolade in the

Construction Manager category at the Construction Industry Council's first Sustainable Construction Award in 2018.

Key among the suggestions from Lai and the buildability study team was the re-engineering of the original excavation and lateral support design so it could be dismantled concurrently during construction of the basement floor, rather than following completion of the ground floor slab. This measure used less manpower and the working environment was significantly cleaner and safer, particularly during flame-cutting activities, as the space was not enclosed. The redesign also allowed the tower crane to be used during dismantling activities and, as longer sections of steel struts were able to be removed, they were more readily reused and recycled – approximately 3,300 tonnes worth, in fact.

Another recommendation from the buildability study was the use of jump lifts that utilised permanent lift shafts and could be operated in all weather conditions, rather than that of external passenger hoists typically used on a high-rise project. The jump lifts were then changed over to permanent lifts in a quick and straightforward process. As well as being safer, workers and building materials were able to reach destination floors more quickly, providing daily savings in manpower during construction.

According to Lai, earlier involvement of contractors in complex projects is the right direction for the construction industry.

"Our close collaboration with Swire at the early stage enabled us to implement comprehensive design suggestions, making the project more efficient and buildable."



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Sammy Lai, Project Leader

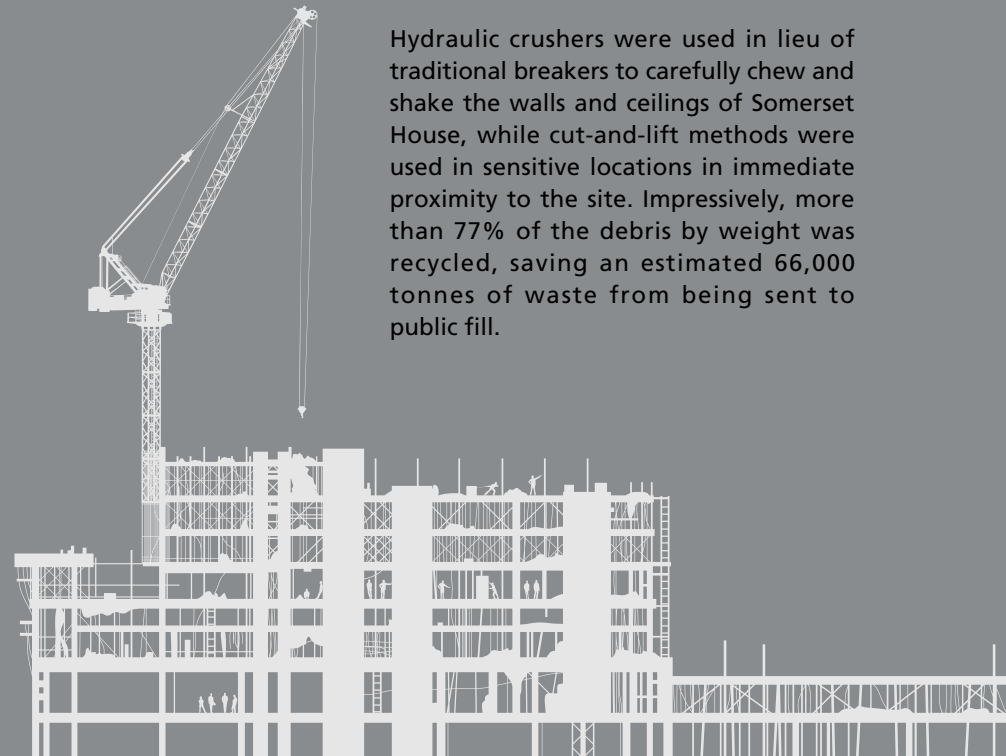


## Eco-friendly demolition

One Taikoo Place stands upon a space previously occupied by a Swire Properties techno-centre called Somerset House, which was demolished by Gammon under separate contract to make way for the new commercial tower.

The demolition was carried out in a way that minimised noise and dust and was eco-friendly, with a strong emphasis on recycling as much of the waste as possible and minimising disturbance to the neighbourhood.

Hydraulic crushers were used in lieu of traditional breakers to carefully chew and shake the walls and ceilings of Somerset House, while cut-and-lift methods were used in sensitive locations in immediate proximity to the site. Impressively, more than 77% of the debris by weight was recycled, saving an estimated 66,000 tonnes of waste from being sent to public fill.







## TOTAL SYSTEM FORMWORK



Less C&D Waste Generation



Safe Working Environment



Less Labour Intensive

Drawing on lessons learned from Gammon's One Island East project for Swire, on which Lai had also worked, a total system formwork approach was adopted for One Taikoo Place, including the use of self-climbing formwork for the core and a tableform for the outer core slab on typical floors.

A more sustainable alternative to traditional formwork, the total system formwork used less timber – the project achieved zero use of timber on typical floors – was safer and less labour intensive.

“We ran a four-day cycle per floor using climbform and tableform, and some handset panels, together with safety screens and formwork hoists,” says Lai. “We did something similar with One Island East, but this time the tableform was modified a lot in terms of weight. Instead of using steel, we

used aluminium, which is lighter and requires fewer workers to push the table – formerly it needed six to eight operatives, but the change in materials meant only two was required, and it was much easier for the workers.”

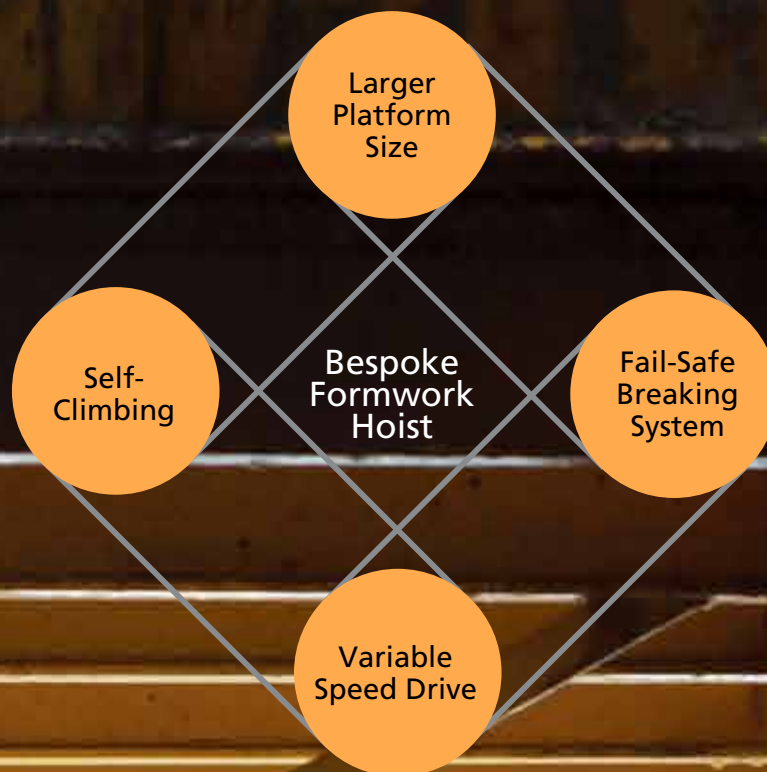
The team even found a way to use the tableform to improve construction of the roof floor slab which was a non-typical design. The tableform could not be directly adopted for construction as the roof was not a typical flat slab design, but it was instead used to replace the falsework system of traditional timber formwork, saving crane time and slashing the duration of roof floor slab formation by almost 50%.

On One Island East, a tower crane was required to deliver the safety screens but One Taikoo Place deployed a self-climbing system. As well as the benefit of efficiency, the self-climbing system saved about 320 deliveries of scaffolding materials – a boon for a project site located in such a busy business district – and a subsequent reduction of 14.5 tonnes of carbon dioxide emissions.

“Not many contractors in Hong Kong have adopted this kind of total system formwork approach, but Gammon has the resources to make it work,” Lai comments.

## BESPOKE SOLUTIONS

Relocating reusable formwork from one floor to another in an efficient manner is a critical element of construction cost and programme. Believing the traditional formwork hoists available on the market could be improved upon to better meet the particular requirements of the project, the One Taikoo Place team worked with Gammon Plant to design and produce their own versatile self-climbing system.



Design and development work began on 2 May 2016, with the first unit manufactured just seven months later. With the demands of the project providing such a small production window, the team adopted components widely used in passenger hoists into its lifting system, eliminating the time that would otherwise have been required for adjustments, modifications and training for workers.

They then set about creating a hoist that met the project's needs.

"Firstly, we made the platform 33% larger than those typically available on the market," says Plant Manager Steve Li, who oversaw the works. "The improvement in platform size represented an improvement in productivity, as larger and greater quantity of formwork could be relocated to other floors per lift."

They then made it self-climbing, eliminating the need to use the tower crane to relocate the track to upper floors, a feature that significantly improved overall productivity and eliminated associated costs.

"Safety was also a key consideration," says Li, "and we were keen to provide the design with additional layers of protection."

This was delivered in the form of a fail-safe breaking system that included an additional disc brake and synchronising shaft to provide further protection in the case of an emergency stop. An automatic safe load indicator also ensured operators did not overload the system, while an audible travelling alarm alerted nearby workers that the hoist was in operation. A programmable logic controller drive with encoder provided continuous monitoring of the system, stopping operations if a fault was detected.

Sustainability was also an important factor, and a variable speed drive was added to lower the hoist's energy consumption by up to 40%.

Overall, the One Taikoo Place team calculated the bespoke formwork hoist provided a threefold improvement in productivity compared with a mid-range model found on the market. The hoist also caught the attention of judges at the Hong Kong Awards for Industries, who awarded it a Certificate of Merit in 2017. Gammon has since patented the invention.



# WINDOWS TO THE WORLD

One of the most aesthetically appealing elements of the project, the fully transparent glass wall on the north and west elevation of the podium, was also one of the most challenging for the team.

Consisting of 22 of the tallest single panes of glass ever installed in Hong Kong – each piece measures 17 metres high and three metres wide – the wall spans the first three floors of the tower and is supported on 1.15-metre wide glass fins. Add a thickness of close to 80mm into the mix and the team was faced with lifting 7.9 tonnes per pane of glass. This weight, combined with the limited working area, required the production of a tailor-made lifter comprising a 360-degree turning table and 14 independently controlled vacuum cups to safely carry out the works.

Preparation work for installation of the glass was thorough, as Phyllis Chen, project manager responsible for the façade, explains.

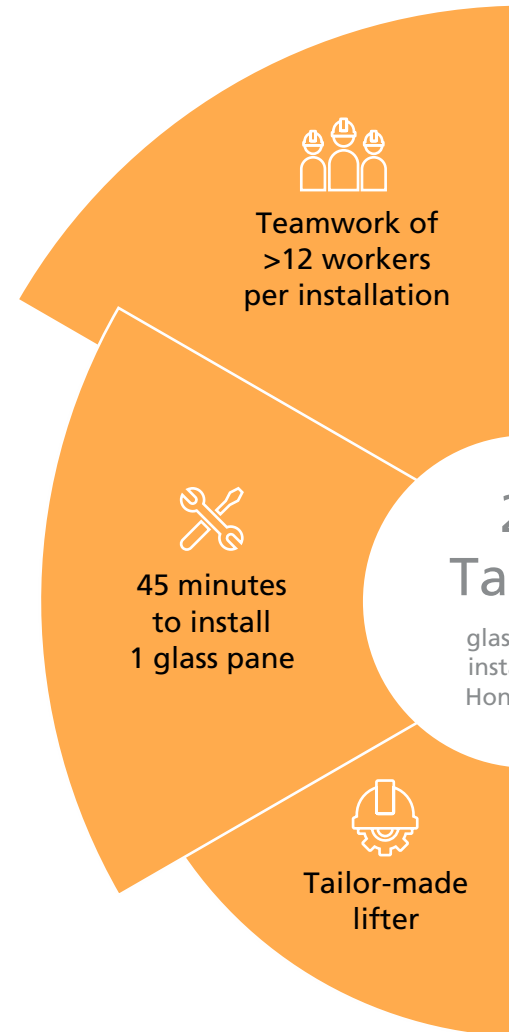
“The riskiest element of the jumbo glass installation was lifting it and therefore it was important to have the lowest

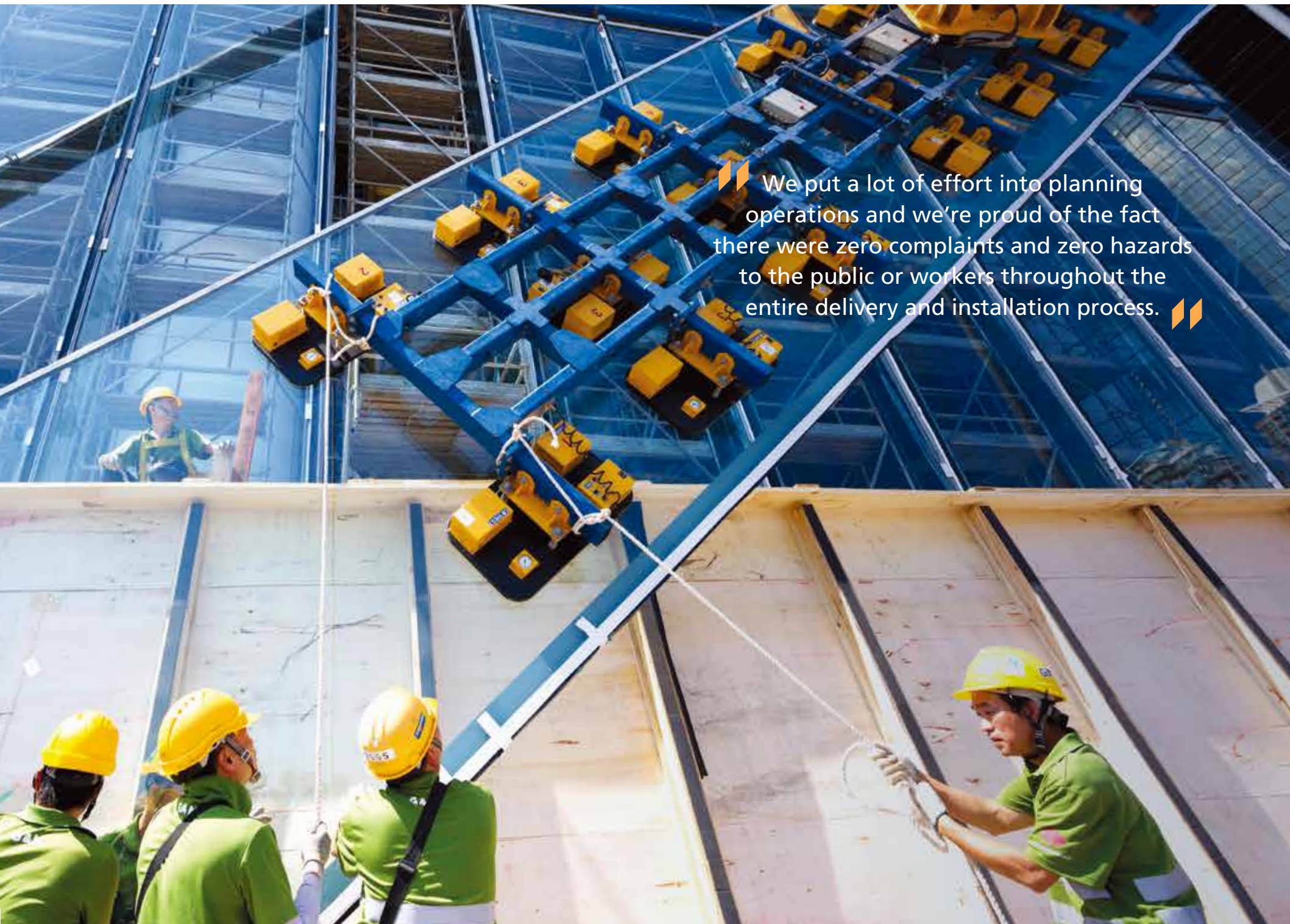
number of lifts. We carried out a trial in mainland China first, using the same group of workers and the same plant that would be involved in the actual on-site installation. We also performed a number of site inspections with the same drivers of the trailer truck and mobile crane, and insisted the subcontractor have almost zero tolerance for bracket installation.”

Precision installation was essential. Embedded into the bottom of each jumbo pane of glass was an 8mm thick, 700mm high titanium plate. Even a deviation of 2mm during installation of the glass would have been highlighted by the titanium, therefore the fit had to be exact. In addition to the vacuum lifter and a cherry picker, between 12 and 15 workers were involved in the installation process for each piece of glass, ensuring everything ran smoothly.

“In the end, the actual installation time for one pane of jumbo glass was only 30 to 45 minutes, which is pretty incredible,” says Chen.

The size of the panels also presented challenges in terms of delivery to the site. A trial delivery run was first enacted





“ We put a lot of effort into planning operations and we’re proud of the fact there were zero complaints and zero hazards to the public or workers throughout the entire delivery and installation process. ”







on computer to ensure the trucks could safely manoeuvre the highways, as well as the tight turns around the built-up site area. A physical trial was then carried out before everyone was satisfied all concerns had been addressed and delivery proper could begin. Panes of glass were then driven to site, piece by piece, after midnight, the only time the extra-long trailer was given clearance to cross the harbour tunnel.

The degree of coordination required to ensure the least disturbance to the neighbouring community throughout delivery and installation of the glass was significant and included entities such as Taikoo Place Management Office, Hong Kong Police Force, Transport Department, Environmental Protection Department and Highways Department.

“We put a lot of effort into planning operations and we’re proud of the fact there were zero complaints and zero hazards to the public or workers throughout the entire delivery and installation process,” adds Chen.

One Taikoo Place also features a three-metre wide unitised curtain wall system, double the usual width for a high-rise building, providing tenants with sweeping unimpeded harbour views. The size of the system, however, created challenges in terms of manoeuvring the glass. During assembly of the units at the curtain wall factory, tailor-made platforms needed to be created to facilitate application of the structural sealant. And with panes measuring anything up to six metres tall and potentially weighing 2.45 tonnes, traditional pallet packing proved

insufficient for delivery from the factory, leading the team to design special racks to cater for their needs. At the site, a tailor-made loading platform with improved volume and lifting capacity was also constructed to transport the curtain wall units to the different floors.

But the need for custom-made solutions didn’t end there. Once at the floor, the weight of the units meant a forklift could not be used to move them around so a pre-cast channel that fit a chain-block mechanism was devised that allowed the team to manually lift each unit and transfer it to four trolleys for easier manoeuvrability.

Installation, too, required a change from typical procedures.

“We had to partially reverse our usual installation procedures due to the extraordinary width of the curtain wall units,” says Chen. “And on top of that, some of the units featured sun shades which made handling them much more complicated. In fact, those units needed to be face up for manoeuvring then face down for installation which added an extra dimension to the process.

“We certainly had to address a number of challenges installing all the glass on the project but I think that’s where Gammon excels, finding bespoke solutions to meet our client’s needs.”

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**INDUSTRY-LEADING  
DIGITAL SOLUTIONS**



## BRIDGING THE DIVIDE

Elevated air-conditioned walkways linking the different high rises are integral to the seamless connection and sense of community of Taikoo Place. On the One Taikoo Place project, two such walkways formed an important element of the contract scope. Gammon's specialist steel fabrication division, Gammon Steel, took responsibility for delivering and installing the works to the client's specification.

Featuring complex bridge segments and curved components, the walkways were designed to call to mind a ribbon curling gently between the buildings. The use of BIM was vital to the process of transforming the conceptual design,

with its numerous non-uniform parts, into a fabrication procedure to a high degree of accuracy.

Not only did the digital model created using BIM increase the effectiveness of design coordination between the steel team and the building team, architect, structural engineer and glass specialist, it also maximised precision fabrication, particularly important for the curved arch members.

"All of the steel plate was cut and shaped utilising computer numerical control cutting machines using data extracted directly from the BIM model," explains Chi Fat Chan, senior

construction manager for Gammon Steel. "This ensured the structure was fabricated to exacting tolerances and guaranteed the all-important connections were precise."

Further assurance was provided by creating a 3D printed model of the walkways that allowed the team to test constructability, gather feedback from analysis and carry out additional design optimisation before building the real thing. Virtual reality (VR) was also used to better visualise and coordinate E&M and construction works and improve the design and building process which, in combination with the use of digital and printed models, reduced

the possibility of abortive works during the construction stage.

Swire personnel, the architect and consultants could step into a virtual space and take a 'walk' across the structure by putting on a VR head-mounted display. It was Gammon's first foray into providing VR walkthroughs for clients and it delivered a useful preview of how the space would look and feel, showed the artistic intent had been met, and provided confidence to the project team that fabrication could continue without the possibility of last-minute design changes. A further VR walkthrough was subsequently carried out on the 6<sup>th</sup> floor.

The structural steelwork for the walkways, about 400 tonnes in total, was prefabricated into segments and preassembled at Gammon's steel fabrication factory in mainland China. Not only did this minimise on-site installation work for improved safety and reduced disruption to neighbouring commercial properties, it also allowed the team to ensure quality and tolerance were within the design requirements prior to delivery, reducing the potential for rework further down the track.

The team also applied a DfMA approach to the temporary framework structures that supported the walkways during installation.

"DfMA was adopted for the falsework design of the walkway and included modular portal support and prefabricated panels," says Chan. "We worked closely with our in-house designer and engineering team, Lambeth, and they were able to standardise beam and panel sizes to maximise the use of steel and reduce the duration of erection which in turn provided time and cost savings to the project. Safety was also improved by replacing on-site welding with bolt connections."

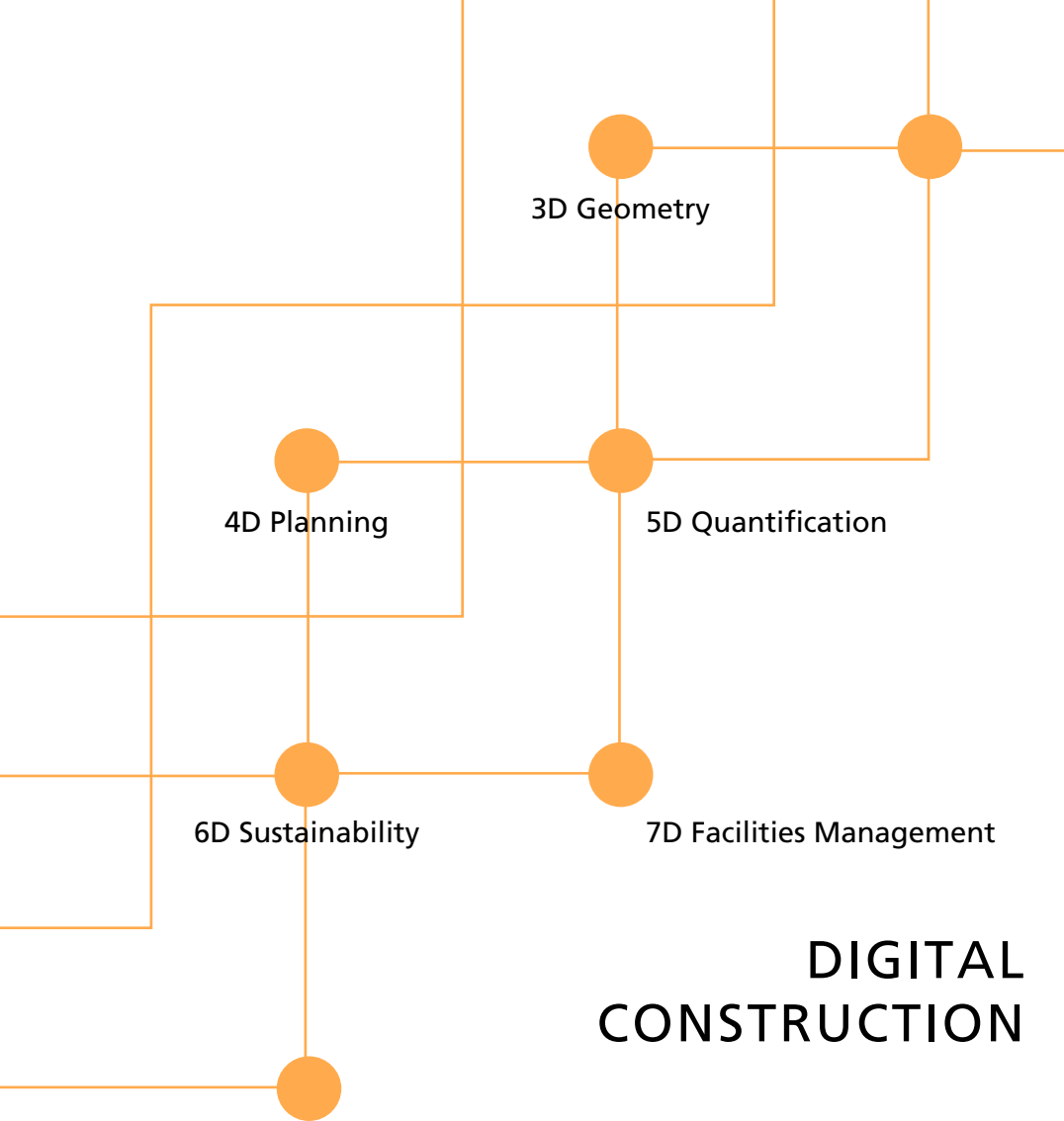
Before installation of the walkways, however, elements of the structure were first put through a trial assembly at the fabrication yard. The main challenge during erection was to maintain curved arch members up to 30 metres long in an accurate and stable position, as the very nature of their track across the roof of the walkway increased the difficulty of installing temporary support.

"Actual coordination extracted from the BIM model was marked on steel components and site surveyors then carried out a check on those reference points to verify the bridge profile," explains Chan. "Connecting the different components presented erection challenges and required continued monitoring and checking of the bridge."

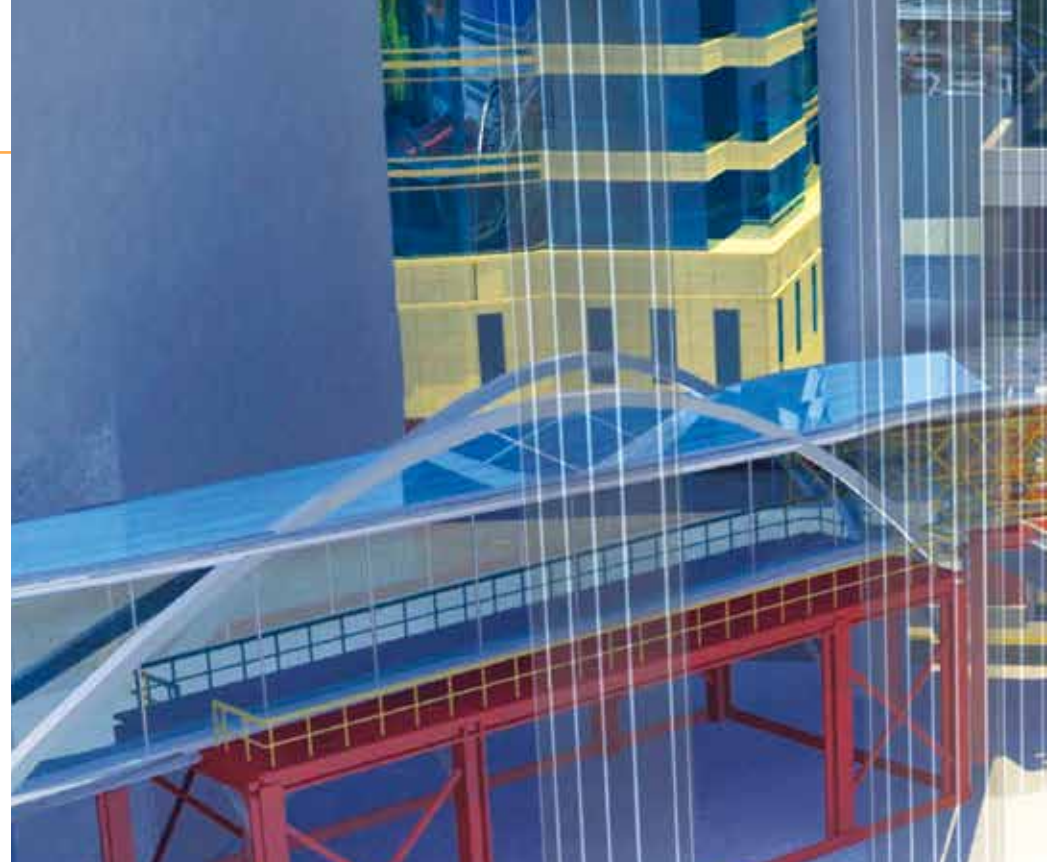
Stress sensors were used to help monitor excessive deflection during the load-transferring process on site. Once sections of the walkways were installed, a 'scan-to-BIM' technique was then applied whereby the as-built structure was 3D scanned and the data reverted to BIM to check there was no unacceptable movement after the load transfer.



Swire personnel, the architect and consultants could step into a virtual space and take a 'walk' across the structure by putting on a VR head-mounted display.



## DIGITAL CONSTRUCTION

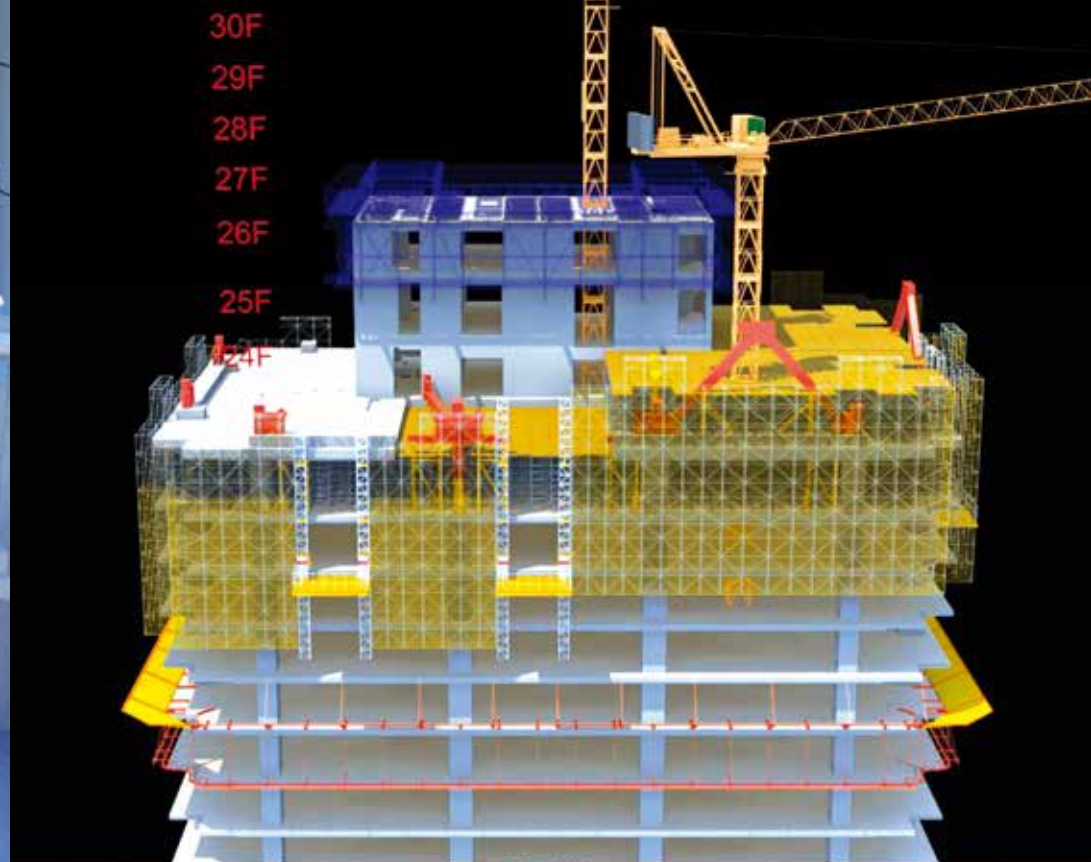


Considered a leader in BIM in Hong Kong, Gammon has committed itself to expanding its capabilities from the typical 3D digital model by adding dimensions to expand its potential applications. On One Taikoo Place, those extra dimensions included 4D (time) and 5D (cost). The addition of 3D scanning provided the team with a further powerful tool to support precision construction.

After taking possession of the site, the team carried out a 3D scanning exercise on the existing conditions to obtain the exact profile, dimension and location of foundations work that had been carried out by the previous contractor.

The accurate data obtained was then integrated with the BIM model so that clash analysis and hazard detection could be carried out prior to pile cap and raft footing construction, resolving conflicts upfront and avoiding abortive works.

“Laser scanning is getting more and more useful for identifying clashes in 3D or even 4D,” says Senior Project Manager Alan Mo. “It has become essential for high-precision erection and co-ordination projects. We used it a lot on One Taikoo Place, particularly on excavation and lateral support (ELS) to perform clash detection between the as-built ELS and the reinforced concrete



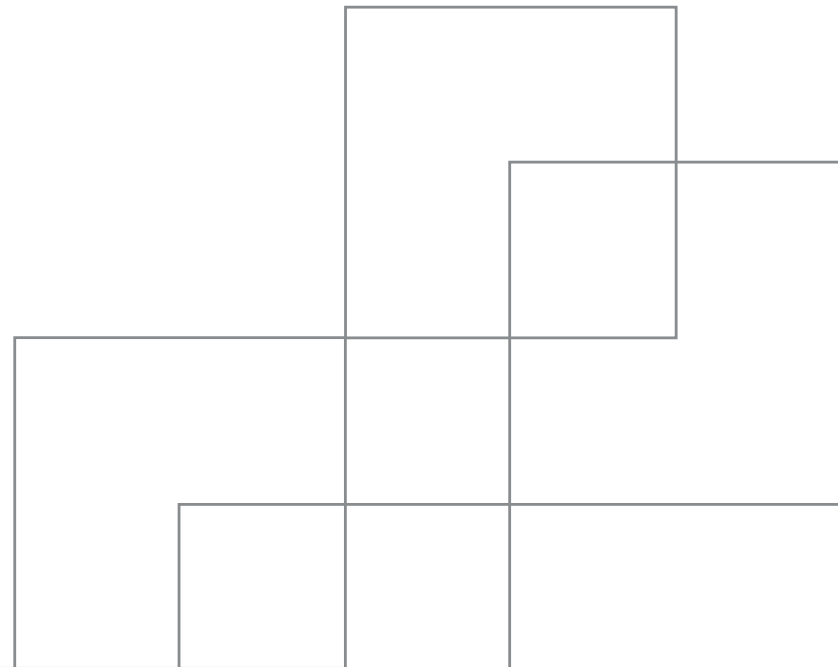
structure. It helped us recognise and assess potential conflicts, such as an ELS steel strut passing through columns, prior to construction of the basement. Potential issues can be raised early, rather than dealt with on site which causes delays and increased costs.

“We also used it following completion of structural works, including the steel truss, to verify the level and extent of final products and ensure all works were constructed within tolerances.”

Integrating the 3D scanning data with the BIM model also allowed 5D exercises to be carried out to provide quantity and

cost calculations. In particular, the fifth dimension enabled a more accurate and automatic calculation of the concrete volume required to pour each bay at the basement, ensuring waste was kept to a minimum.

Sitting on the critical path of the programme was the tower’s outrigger system which runs from the 24th to the 26th floor and provides lateral stiffness to the structure. Due to its criticality to the programme, the team integrated the BIM model with the outrigger floor construction schedule to create a 4D simulation that visualised the entire series of construction events. Armed









“As a company, Gammon is steadily working to turn construction activities into digital information that can be processed and analysed to improve efficiency, safety and productivity. Together with BIM, this forms a key element of its drive to achieve integrated digital project delivery – the bringing together of design, planning management and tracking.”

with a greater understanding of the interaction between different elements of site activities as the works progressed, the team was able to carefully review the sequence, fine-tune where necessary, and improve site logistic planning to reduce the possibility of delays.

“In fact, we carried out 4D BIM simulations on a monthly basis to optimise and refine the construction sequence and methodology, as well as site logistics,” says Mo.

Using the same technique that created a virtual reality experience for the walkway, the BIM model was also integrated into a 3D gaming environment to improve safety training. Using a 3D head-mounted display, workers, engineers and even supervisors were immersed into a virtual reality scenario that improved their understanding of falsework inspections and how to recognise defects.

Gammon’s in-house Digital Transformation team also applied robotic process automation to capture the latest design submission status automatically, providing the project with significant time savings over the traditional manual methods typically used by contractors. The real-time overview and enhanced control over the entire submission procedure also improved a process often associated with project delays.

A pilot study integrating BIM with in-house developed software robot Gambot™ was also carried out to improve monitoring of construction progress.

“During alteration and addition works at neighbouring Lincoln House, frontline workers submitted progress information such as subcontractor, location, labour and percent complete through our Gambot app,” says Terence Lui, who

heads up Digital Transformation. “This information was combined with the planning programme using an algorithm, and the data was then merged with the BIM model to create a visualisation of the current work status.”

Beacons were also used to track labour on the site and, using advanced data analytics, measure the productivity of workers, allowing management to rearrange resources in more effective ways if necessary.



  
Restricted Zone  
Monitoring

  
Safety Equipment  
Monitoring

  
Vehicle  
Monitoring

Industry recognition for Gambot: accolades include Gold in the Safety Management System, Training and Promotion category of CIC's 2018 Innovative Safety Initiative Award; regional winner at the International Data Corporation's Digital Transformation Awards 2018; Innovate Jardines Grand Prize; and Gammon Innovation Competition Grand Prize



Worker  
Monitoring



Plant  
Monitoring

## HARNESSING THE POWER OF ARTIFICIAL INTELLIGENCE TO IMPROVE SAFETY

One of Gammon’s most successful and widely used innovations was also initiated during the course of constructing One Taikoo Place. Gambot, a software robot with artificial intelligence (AI) that collects, stores and analyses site-related data, came into being after Lai approached Gammon’s Information Management Services (IMS) team for help creating a photo-management system to control the considerable number of images being produced on One Taikoo Place.

But what IMS provided in Gambot was something much more, something that was to have a profound effect on the efficiency of reporting on the project, particularly that related to safety.

IMS delivered a “mobile virtual assistant” that, as well as being integrated with IT systems such as Site Diary for the collection of site photos, provided a function to allow operational staff

to submit safety observations and dynamic risk assessments. The easy-to-use conversational interface included a messaging app with guided questions, such as a request to describe a safety event and the respective action items. The entire safety reporting process was taking less than two minutes, a significant improvement over traditional methods.

Staff could even ask Gambot questions and get immediate answers.

Such was its success on the project, further functions were integrated such as i720 which focuses on quality checking, and Gammon’s concrete management system. Providing it with an understanding of image and video, Gambot was also successfully trialed to actively monitor if workers had entered pre-defined restricted or no-entry zones and to generate an appropriate alert.

With submissions centralised and classified into different categories, management was able to strategically plan and monitor timely actions.

“It’s very useful for record keeping and progress checking,” says Lai. “It significantly improved our safety management process and supported a strong culture of Zero Harm.”

Gambot is now used on all Gammon projects to submit safety observations and dynamic risk assessments and is continually updated with further functions. The application of a computer vision algorithm allows it to detect objects including faces, vehicle plates, equipment and so on, allowing project teams to monitor productivity, or safeguard against entry to secured zones. It is even used to create bored pile scheduling.

**Innovation  
distinguishes  
between a leader  
and a follower.**

Steve Jobs,  
former Apple co-founder and CEO



Annual energy savings would exceed BEAM Plus and LEED baseline performance by **33%** and **28%** respectively

**2.5%** of the total building energy provided by renewables

## DRIVING EFFICIENCIES

From the outset, Swire's target was that 2.5% of the total building energy was to be provided by renewables, and that annual energy savings would exceed BEAM Plus and LEED baseline performance by 33% and 28% respectively.

Around a dozen passive and active energy-saving strategies were implemented in order to reach these targets, ranging from sun-shading fins and a waste-to-energy bio-diesel tri-generation system, through to a high-efficiency chiller and photovoltaic panels.

The bio-diesel tri-generation system, the first of its kind to be installed on a Hong Kong commercial building for normal power supply, was not unfamiliar to Gammon who had fitted the city's first on its Zero Carbon Building project back in 2012. The system supplies heating, cooling and power

generation to One Taikoo Place, with waste heat from electricity generation driving the adsorption chiller which provides chilled water for the cooling and dehumidification system. Used cooking oil generated by Swire food and beverage tenants is converted into biodiesel by third-party recyclers to help power the system for further reductions in organic waste and carbon footprint.

But some of the greatest contributors to saving energy at One Taikoo Place are far more straightforward. Air handling units, typically fitted with one fan, were installed with four electrically commutated plug fans, a type already widely used in Europe and North America, to provide far greater operation and extra reliability. Sun shading fins, rarely seen in Hong Kong, were installed at the top of the tower to maximise heat reflection away from the building and

into the sky while also maximising light transfer in. The depth of the fins vary according to the changes in environment at different levels. Photovoltaic panels and green planting graces the roof.

According to Sustainability Manager Erica Lam, the building is considered one of the most sustainably built and operated commercial buildings in Hong Kong.

'One Taikoo Place is a great example of the energy savings that are possible in commercial buildings these days. Even small actions can add up to major savings, and the subsequent reduction in greenhouse gas emissions provides a benefit to the entire community.'

Behind the scenes, Gammon was also working with its supply chain to initiate efficient and sustainable methods of

construction for many of the electrical and mechanical aspects of the project. At the roof, the original seven cooling towers specified in the contract would have required installation of individual parts, piece by piece, in situ. Using a DfMA approach, Gammon proposed a modular route, as Building Services Manager Michael Tong explains.

“A modular approach provided numerous benefits to the project. Instead of workers and materials squeezing onto the limited roof space to carry out installation, we worked with the suppliers to prefabricate the cooling towers into two parts, or modules, off site and these were then delivered to the roof and joined together.

“This method not only saved space and reduced the number of workers needed to carry out the task, it was also much faster to install.”

Gammon’s building services team also proposed a modular approach for installation of the condensing water pipes.

“Traditional methods would have involved delivering proprietary 6-metre long sections of pipe to the roof for welding and jointing in situ which can lead to a messy work site and a lot of waste material,” says Tong. “Instead, we used BIM to work out actual measurements and coordinated with the supplier to create bespoke sections that were pre-joined at the factory into modules, which the tower crane then delivered in one go to the roof. There was a lot less welding required, as well as less wastage created.”

The team also carried out an early review of Swire’s planned photovoltaic panels for the roof and were able to propose an alternative design that was higher efficiency and reduced the total number of panels required.

“We have a very strong focus on sustainable construction at Gammon so there was a real synergy with the client’s vision for One Taikoo Place,” adds Erica Lam.





# ENHANCED QUALITY CONTROL THROUGH IN-HOUSE SOLUTIONS

Considered among the most important in-house information system developments of recent years, Gammon's i720 system was used on the project to enhance traditional defect recording and rectification and to analyse the subsequent records to improve process management, planning and control.

Operating through the company's software robot with AI, Gambot, the i720 system allows the logging of defects by floor plan or through a tablet to provide increased flexibility of record-taking in different environments. It also identifies different defect types automatically, such as honeycombing where small voids may form in concrete.

Senior Project Manager Felix Lo estimates using i720 on the project halved the time required to deal with quality rectification.

"Traditionally, we would take photos of any issues, return to the office, upload them to the computer, mark the defects on a 2D plan, copy over the images, and issue a hard copy to the subcontractors to address. This was very time-consuming. As i720 is a common platform, we could take the photos, touch our tablet screen and append the image to the floor plan, all while out on site. It took a matter of seconds."

Relevant sub-contractors are also notified immediately after confirmation of a reported defect into the system.

Unlike the traditional defect and rectification process where records can be difficult to retrieve, i720 gave the project team access to important data such as how many defects were being addressed each day and by which subcontractors.

"This is useful data," says Lo. "It provides a record of subcontractor performance in certain areas and can influence decision-making in the future."

Subcontractors and consultants also used i720 and, for the first time on a Gammon project, the client was given access and was able to record any issues and have them processed through the same system. Once the recorded issue was rectified, it was photographed and documented in i720 and Swire's inspectors could then generate a defect summary on the same day.

"Giving Swire access to i720 meant they could access the latest defect data and statistics which could be used for their own internal reporting, rather than wait on periodic paper reports from us," says Lo. "They are also then free to carry out their own further analysis such as what kinds of materials or design details proved to have the most defects, which would be useful information to have when planning future projects."



Progress Report



Safety Forms



Commercial Forms



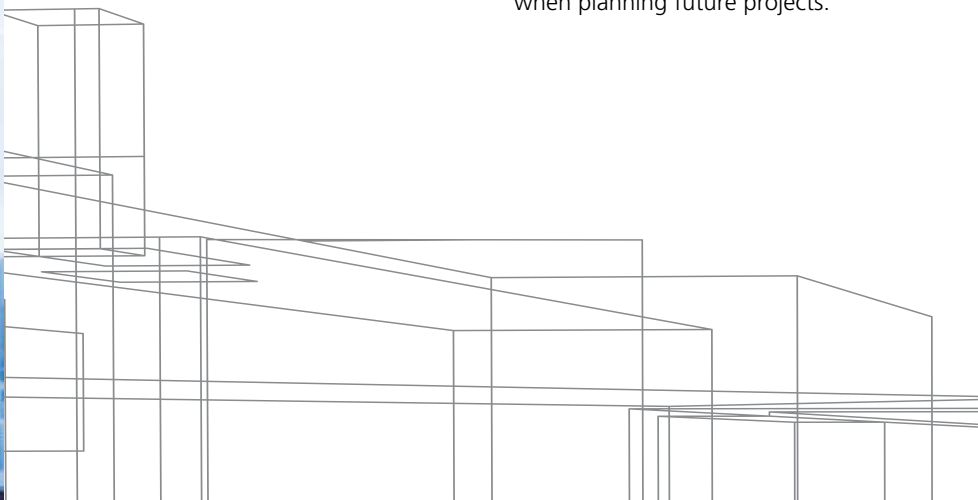
Data Classification



Schedule Optimisation



Big Data Analytics





Hong Kong's first project of this scale to fully utilise offsite computer controlled cut and bend of rebar

Reduce  
**50%**  
labour  
requirements

## COLLABORATION THAT BENEFITS ALL

Taking a co-creative and collaborative approach to working with the value chain, one of Lai's immediate actions after contract award was to bring together all major subcontractors to drive the formation of a project execution plan that covered every element of the works, highlighted all major concerns and provided early solutions that focused on quality outputs so abortive works, both costly and wasteful from a time and material usage viewpoint, could be avoided and more sustainable measures adopted.

The plan included a 'wish list' section for each area of works that was discussed with Swire and focused on how to have





improved output during delivery of the works. Some of the improvements developed with the supply chain were firsts for Hong Kong, as Lai explains.

“We were the first project of this scale in Hong Kong to fully utilise offsite computer controlled cut and bend of rebar which resulted in less wastage, lower labour requirements, a minimisation of noise disturbance to the neighbourhood and enhanced waste recovery.”

In fact, the proposal led to a 50% reduction in labour requirements and achieved a project-specific rebar wastage target of just 3%. It also provided a safer factory-controlled environment for

workers to carry out their activities and meant passageways on site were better able to be maintained to reduce trip and slip hazards.

After identifying improvements that could be made to fitting-out works, Gammon collaborated with the subcontractor to change the design and method of fixing wall panels from wet fix to prefabricated panels that were dry fixed on site. Not only did this approach result in a tidier and safer work environment, productivity and quality of end product was also enhanced.

“Ultimately we positively influenced how the subcontractor normally worked to

add value to both the project and their own business,” says Lai.

Gammon’s advice and support on the design of the tableform led the system formwork supplier to include improvements in safety, such as built-in guard rails, and the use of a lighter material to improve manoeuvrability. Ultimately, the supplier was able to obtain a patent on the unique end product.

“We empowered the supply chain to deliver a better product, even if that eventually benefits our competitors,” points out Lai. “But when it comes to improvements that provide safety

and environmental benefits, we have a responsibility to share them for the betterment of the industry as a whole.”

Responsible management and support of staff and workers is also a priority for Gammon and the One Taikoo Place project was the first in Hong Kong to trial exoskeleton suits, devices that support the body to lift heavy loads. Using the suits, workers could more comfortably lift heavy items while minimising the risk of long-term back injuries – a common complaint among construction workers. The suits have since been adopted on other Gammon sites.



To minimise the potential for mistakes, the stone was 100% pre-laid in Quebec before being shipped to Hong Kong. Computer control cutting machines were also used to ensure precision fabrication of each slab.



Brown Picasso stone





## BREATHING SPACE

Taikoo Square, the landscaped space to the south of One Taikoo Place, is something of a rarity in Hong Kong. When taken in combination with the planned garden of the future Two Taikoo Place development, it will become one of the largest landscaped spaces connected with a commercial area in the city.

Featuring lush greenery and quiet pathways, the garden provides an outdoor area for the enjoyment of the entire community. Part of its aesthetic appeal can be attributed to the use of a deep black stone unique to the province of Quebec, in Canada. Called Brown Picasso, it was also the element of landscaping works that proved the most challenging for the project team.

Not only did the quarry's distant location complicate logistics, it was also closed for about six months of the year during Quebec's winter months.

"We set milestones very early in the project," says Construction Manager Walter Lee. "The window for fabrication and delivery was small so we needed to firstly be absolutely sure of the design, to set and maintain target dates, monitor them closely and make our expectations clear."

"Obtaining drawing approval and quality control were big challenges and we had to closely monitor the factory to ensure they complied with the design."

"Good management of the supply chain was crucial."

With the Brown Picasso stone used on landscaped areas that included curves, cantilevers, angles and grading changes, many of the stones were also unique in shape and size. The use of BIM was imperative to working out the installation sequence and interface detail before preparing fabrication drawings and cutting sheets.

**SPIRIT OF  
TEAM WORK**





## STRENGTH IN UNITY

“No man is an island entire of itself” wrote English poet John Donne, meaning none of us can be truly self-sufficient but must rely to a certain extent on others.

For the One Taikoo Place project team, support and expertise was available through Gammon’s impressive range of in-house divisions and specialist departments, all united by a shared mission to improve productivity, safety and quality.

“We have such a wide range of specialist knowledge to call on,” says Lai. “It really supports excellence in project delivery.”

Taking a partnering approach to working with its supply chain, Gammon also shared its knowledge and expertise to improve traditional processes and practices to benefit not only One Taikoo Place, but also positively influence future work carried out on projects within the industry in general.

The atmosphere of unity extended beyond the site boundary, with Gammon’s Foundation division, which had previously demolished Somerset House, also awarded the contract to bring down next-door Warwick House to form the site of the future Two Taikoo Place development.

“There was a lot of coordination needed between the two contracts and because we were both from the same company there was a good synergy between us,” explains Lai. “The site entrances to both projects shared the same road, so if either of us needed to block it off the liaison process was straightforward. We were very mindful of their needs, as they were of ours.”

Gammon Steel also played a significant role, taking responsibility for delivering the elevated outrigger, roof steel frame and all-important elevated walkways.

Gammon’s relationship with client Swire completed the strong sense of team spirit evident on the project. With Gammon having previously delivered seven office towers in Taikoo Place, the two companies had a long history that strengthened their partnership.

“It helped that we had a pre-existing relationship with Swire. We knew we worked well together. There was a strong sense of being a unified team backed by mutual trust,” says Lai.



## A 'CAN DO' CULTURE

One Taikoo Place was not without significant challenges for the project team. In particular, they faced pressures of time and issues of site constraints including access for deliveries in a built-up area, limited storage and the need to keep noise and dust to a minimum to avoid disturbing neighbouring businesses.

But Gammon rightly prides itself on its 'can do' culture, where challenges simply become opportunities for innovative thinking, and where good planning and good management form the foundations of success.

"We finished fire services inspections in only 19 days," says Lai, by way of example. "That's an incredible achievement. Typically a project like this would take eight to 12 weeks, but we led a collaborative effort with the consultants, client and contractors, planned ahead, maintained a good level of communication with the inspectors and arranged the sequence well."

The spirit of innovative thinking instilled in the minds of the team also reaped rewards. From digital through to modular solutions, improvements were able to be made across a wide spectrum of the project, all of which supported timely and safe delivery of the works, some of which also gained public recognition through a number of industry awards.

"I think One Taikoo Place is a true demonstration of what the Gammon 'can do' culture can achieve," says Lai. "Ultimately we delivered on our promise, but as a team we accomplished so much more."



Good planning



Good management



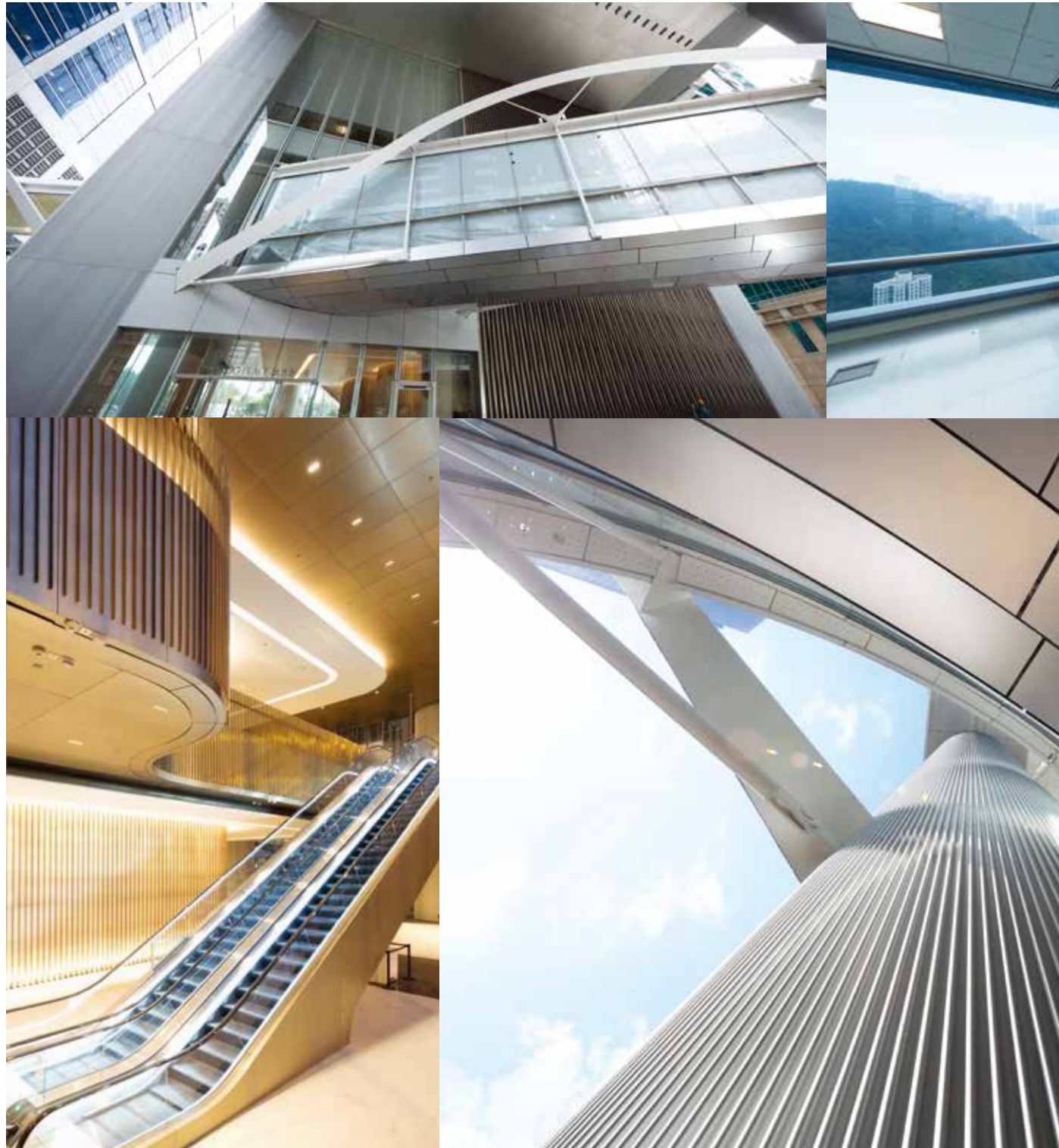
'Can do' spirit







One Taikoo Place represents the possibilities for positive change to the environments we work in, as well as to the way buildings are constructed.







“ One Taikoo Place is a true demonstration of what the Gammon ‘can do’ culture can achieve. ”



