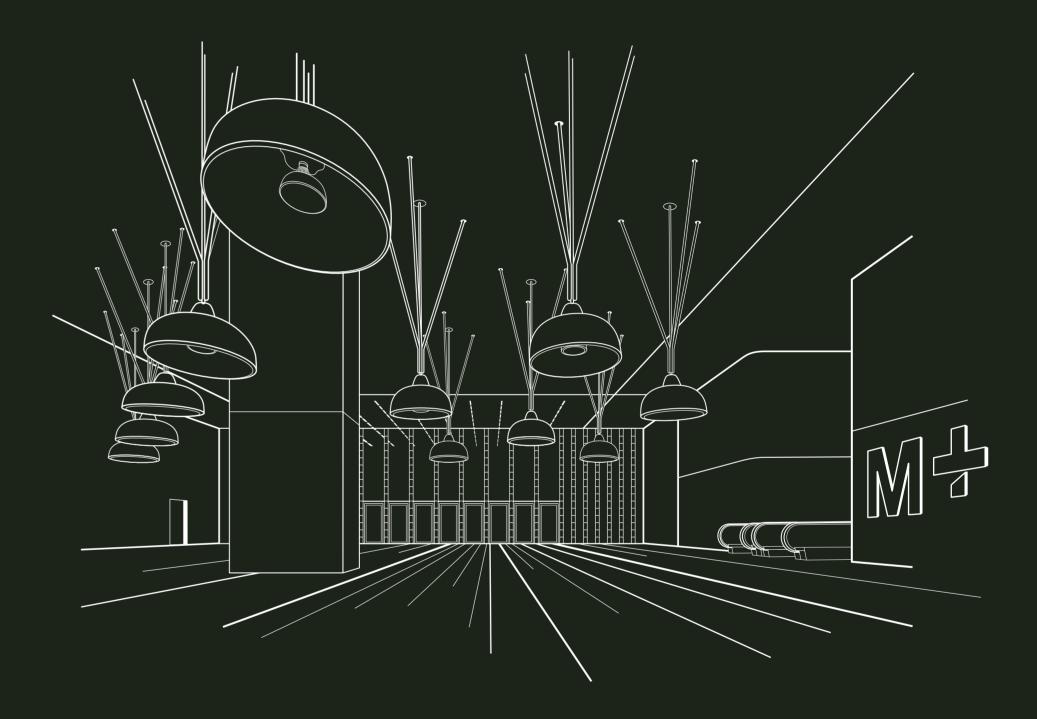


M+ is an outstanding new addition to Hong Kong's cultural landscape, a showcase of some of the finest examples of architecture to be found across Asia and the world. It has been made possible by a team comprising the world-renowned architectural firm Herzog & de Meuron, TFP Farrells and Arup, whose vision for this 21st century monument to visual culture has been realised by Gammon Construction Limited.

Now open to the public, M+ is a welcoming space offering multiple opportunities to view, learn and be inspired by the best that the world of contemporary visual culture has to offer

Creating the M+ Building





Creating the **M+ Building**



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I am pleased to present this commemorative book recounting and celebrating the progress that has been made on this new museum, which has drawn the attention of the global community and placed Hong Kong on the world cultural map. Until now, Hong Kong had not been widely regarded as an artistic and cultural centre of the same calibre as New York, Paris or London. That is most likely to change with the opening of M+ and its world-class collections of modern and contemporary visual culture.

Bringing this project to completion was at times difficult, particularly with the onset of the COVID-19 pandemic in early 2020 and its subsequent pressures on supply chains and manpower. We also had to meet the exact specifications of the project team. But these were challenges welcomed by our engineers, who relished the opportunity to use all their skills to make this remarkable project a reality.

We are proud of the role we have played on the M+ project and invite you to read how it came into being in the pages of this book. I also hope that it motivates you to visit this remarkable new building in the West Kowloon Cultural District and to see for yourself the incredible collections now on display there.

Thomas Ho

Chief Executive (retired)
Gammon Construction Limited

M+ is a magnificent iconic project that my predecessor, Thomas Ho, and the Gammon team have helped to create for Hong Kong. Executing a project of this magnitude and complexity underlines the strength of Gammon's commitment to quality, innovation and craftsmanship. This was evident right from the beginning of the company's involvement with M+ and is described in detail throughout the pages of this book.

The project was also an opportunity for us to work together again with globally renowned architect Herzog & de Meuron and their partners TFP Farrells and Arup.

With the completion of this project, Gammon has succeeded in meeting the client's design for a new visual culture museum in Hong Kong that rivals other leading museums around the world. Together with another project built by Gammon (the nearby Lyric Theatre Complex), M+ also helps to fulfil the vision for an arts and cultural hub in Hong Kong that will be cherished by all for many years to come.

At the beginning of my tenure as the Chief Executive of Gammon, I am inspired by Thomas's leadership of the team, which has made this spectacular new landmark in the West Kowloon Cultural District a reality. I join him in encouraging everyone to visit M+ and the treasures contained within its walls.

Kevin O'Brien

Chief Executive Gammon Construction Limited







Exhibition Spaces

M+ has been Asia's first global museum of contemporary visual culture, dedicated to collecting, exhibiting, and interpreting visual art, design and architecture, moving image, and Hong Kong visual culture.

This is immediately apparent upon entering the Main Hall on the ground floor of this remarkable new museum, where the eye is drawn towards the voluminous central area linking the exhibition spaces that showcase some of the world's finest items of contemporary visual culture. On the basement and podium levels, 33 galleries and other exhibition spaces cover an area of 17,000 square metres, comparable with the now-expanded Museum of Modern Art in New York.

Many of the architectural finishes and works for the exhibition spaces were extremely complicated to execute, due in part to their fine tolerances, assembly of materials and high standard of workmanship required by the architect. As the management contractor of the project, Gammon not only met these challenges but succeeded in bringing to life the architects' vision for this iconic new museum for Hong Kong.

展覽空間

M+ 不僅是一座別樹一幟的新型博物館, 更是二十和二十一世紀涵蓋視覺藝術、設計 及建築、流動影像,以及香港視覺文化的 當代視覺文化博物館。

當訪客步進這個嶄新的的視覺文化博物館, 地下大堂的空間便盡收眼簾。在這個寬敞的 地下中庭,展示了M+精選的當代藝術的 藏品。33個展廳及其他展覽空間面積達 17,000平方米,能媲美剛擴建的紐約現代 藝術博物館。

建築和展覽空間的各項工序大多極為複雜,需要建築師的精密量度和計算,配以優良的物料組裝和精湛的技術。縱然如此,金門作為項目的管理承建商,仍能迎難而上,成功實現建築師的願景,為香港創造標誌性的新文化地標。





Found Space

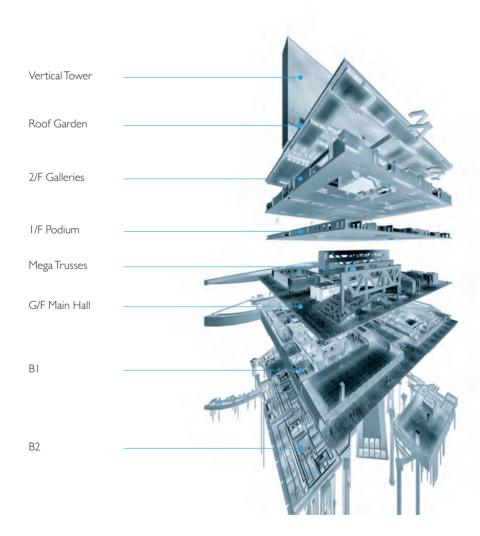
Building over the tunnels of an existing live railway — MTR's Airport Express Line and Tung Chung Line — would have been considered an insurmountable challenge by many architects.

For the architects of M+, however, the tunnels were not a problem to be overcome, but an opportunity to be exploited. Rather than attempting to hide or minimise the tunnels underneath the building, they took the bold decision to embrace the constraints and use them to create one of the museum's most distinguishing features.

Nevertheless, the construction of this 'Found Space' had to be handled with extreme care. Only minimal loading and vibration could be applied, as any movement might have interrupted the service of one of Hong Kong's most critical modes of transport.

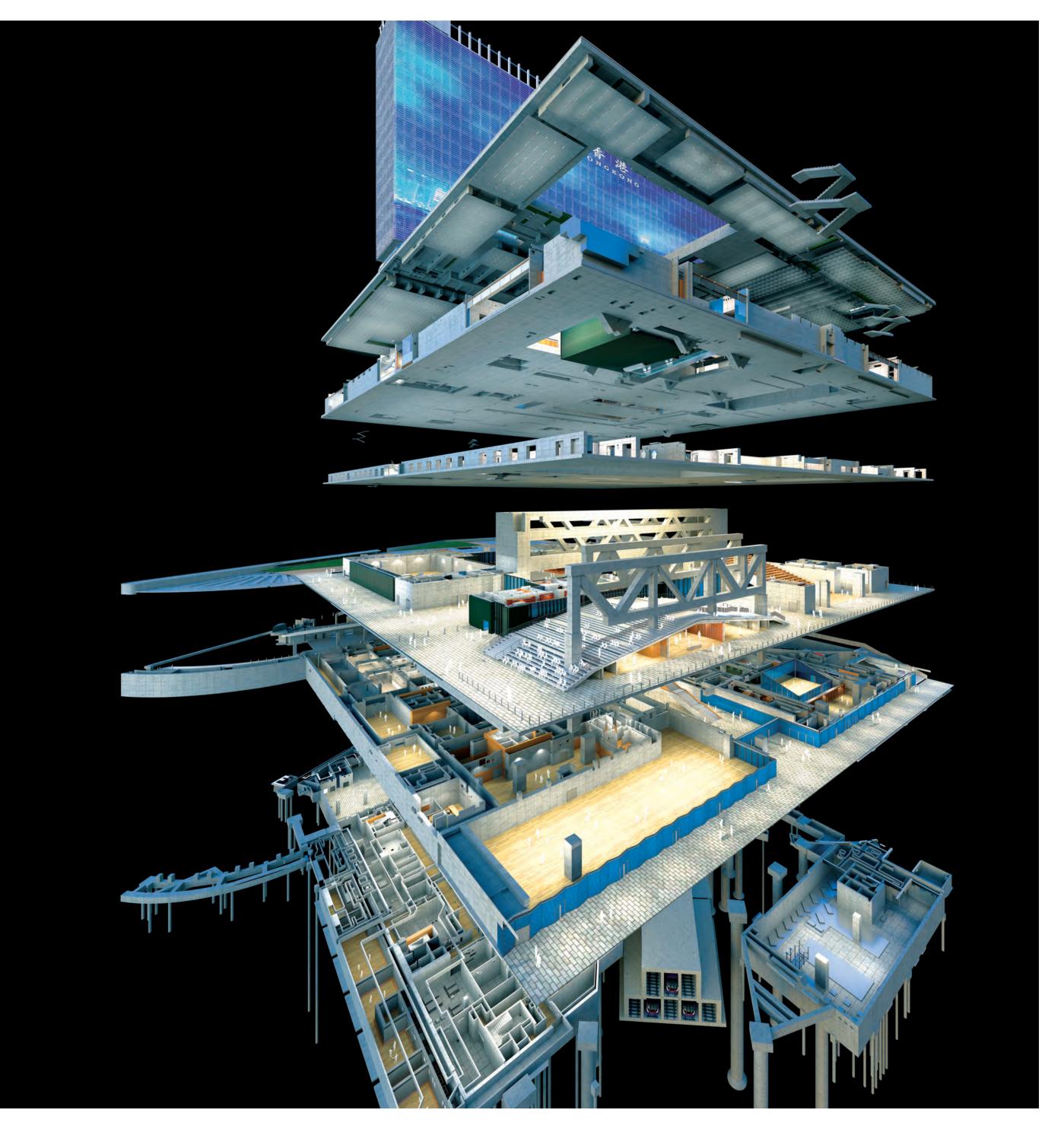
Fortunately, members of the Gammon team had experience working on the Lyric Theatre Complex, which is also situated near the Airport Express Line tunnel. The solution for M+ from the engineer was to erect mega-size trusses on the lower level of the building to support its weight over the railway tunnels. This was the first time that such an approach had been taken on any construction project in Hong Kong.

The end result was expressed within the Main Hall as a series of diagonal elements that mimic the diagonal footprint of the railway tunnels, while also providing room for M+ to stage large-scale installations.



Exploded digital illustration of the podium

Two pairs of mega-size super trusses support the podium and transfer its weight away from the railway tunnels.



Artisanal Finishes

Fair-Faced Concrete Most of the concrete surfaces of M+ make use of 'fair-faced' concrete, a type of concrete with an aesthetic finish. This was the first time in Hong Kong that this concrete finish had been used on such a vast scale. To achieve the desired effect, concrete was poured into moulds made of wooden boards that were imprinted on the concrete surfaces, giving them an organic wooden texture. The timber boards were then recycled to create additional batches of formwork. Since the wooden boards making up each mould differed slightly, this contributed to a subtle variation of patterns for each wall panel.

Ceramic Tiles The ceramic tiles chosen for the M+ Facade were in tribute to Hong Kong's distinctive Chinese tiled buildings. Cast in Florence, Italy, and formed into prefabricated panels in Shenzhen, China, the 1,590 modular tile units cover the vertical tower and podium. A unique feature of these panels is their colour, which is ostensibly green but in reality perceived as having many different colours and textures, depending on the angle of the sun and the perspective of the viewer. This effect was managed in Shenzhen, where individual tiles were placed in moulds to form each precast panel.

The entire process, although heavily labour intensive, helped to achieve the natural characteristics desired by the architect and celebrate the artisanal skills of the tile-makers. Despite the use of modern technology to produce the tiles, they appear to be a handmade product.

Oak + Bamboo Throughout M+, oak and bamboo were extensively used for the flooring, wall coverings and bespoke furniture. These materials were chosen not only for their aesthetic properties, but also for their ability to withstand Hong Kong's notoriously humid conditions. All flooring and wall coverings were manufactured off site and delivered by road to Hong Kong for installation.

Above

G/F Main Hall

Ceiling height: 6 metres

The spacious public entrance is accessible from all sides and allows visitors to view the unique spatial qualities and materials used at M+.

Left:

Ceramic Tiles

752 ceramic curtain wall units for the podium

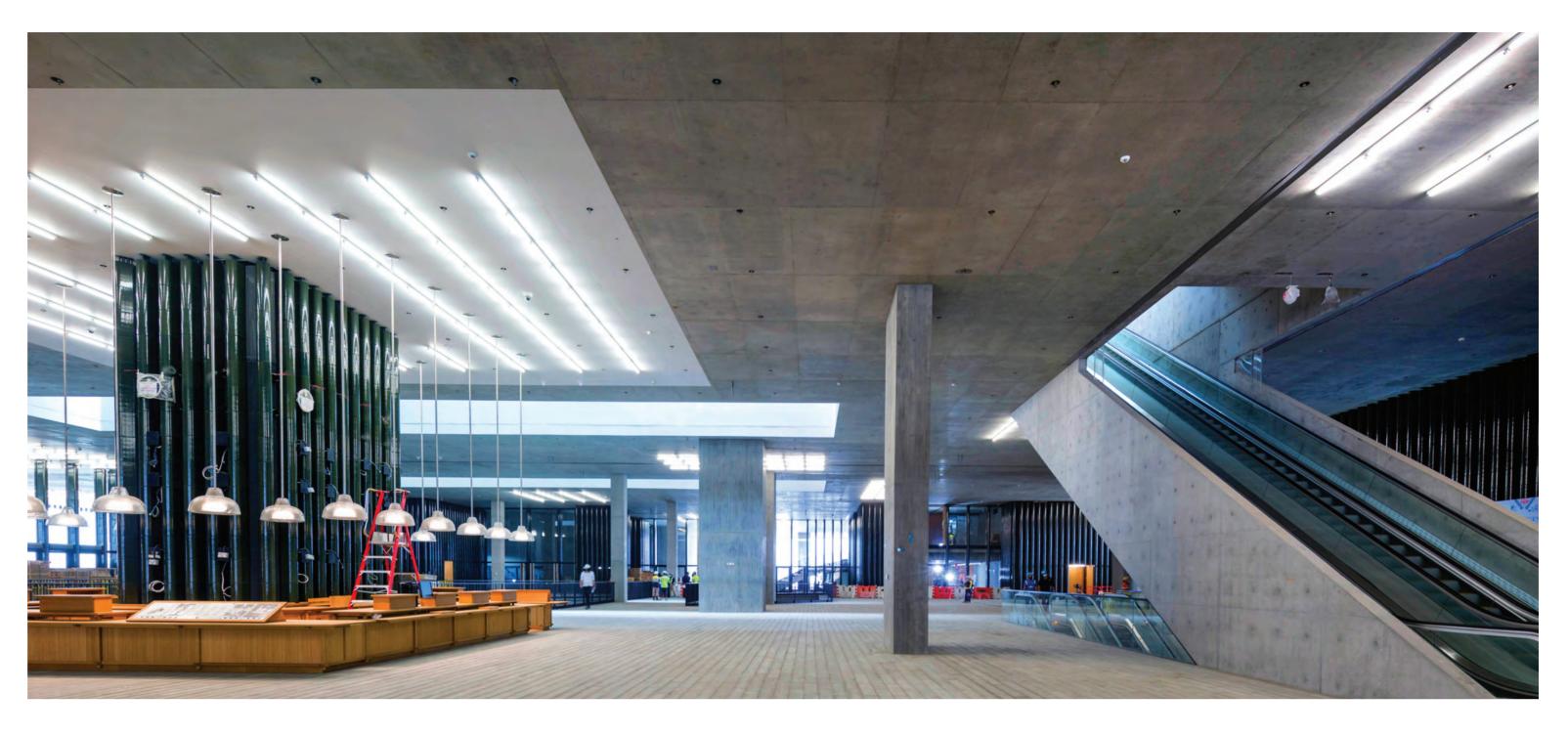
The distinctive corrugated ceramic tiles of the M+ Facade reflect the changing conditions of light and weather.

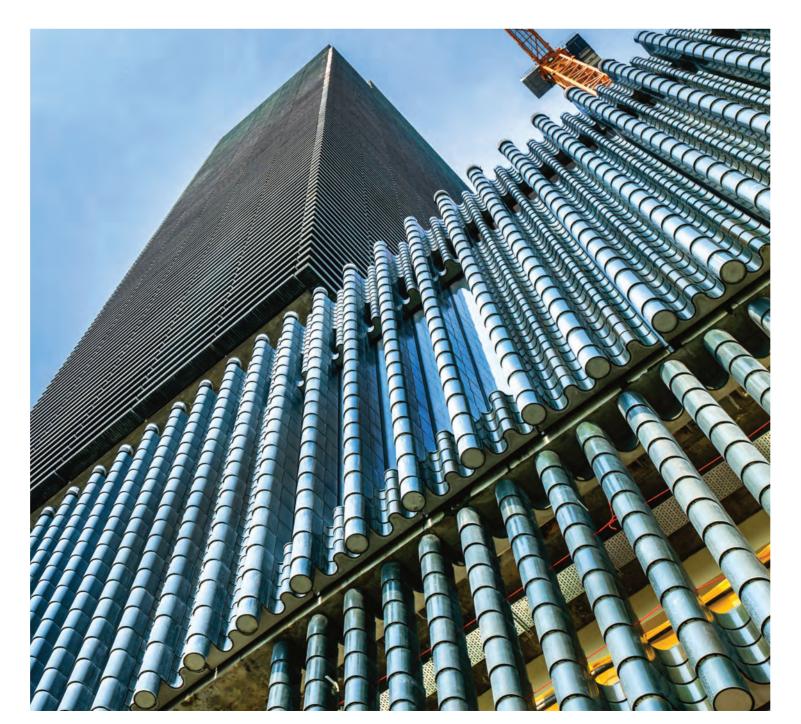
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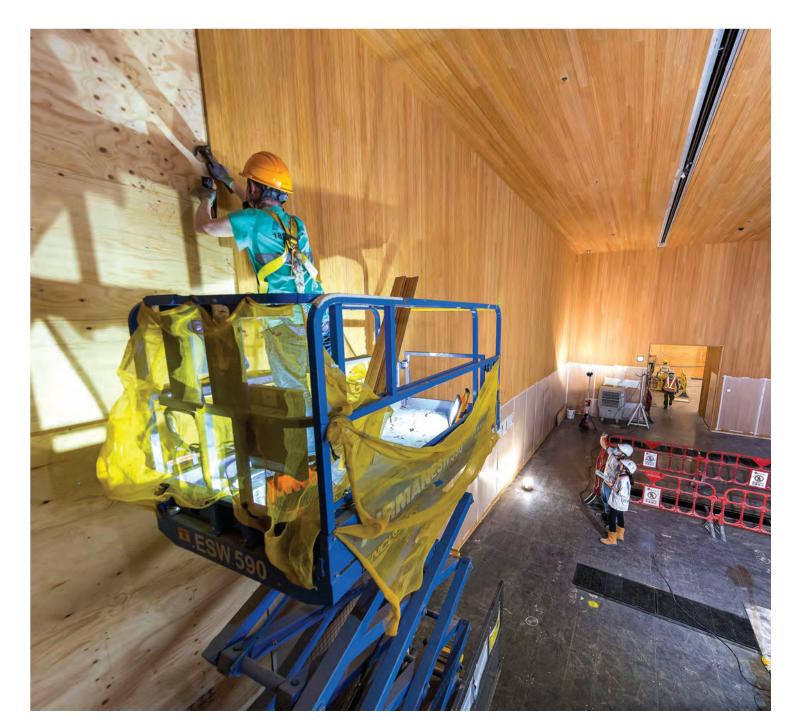
Oak + Bamboo

M+ interior timber finishes

Oak and bamboo are used in combination to form attractive, warm and welcoming spaces throughout M+.







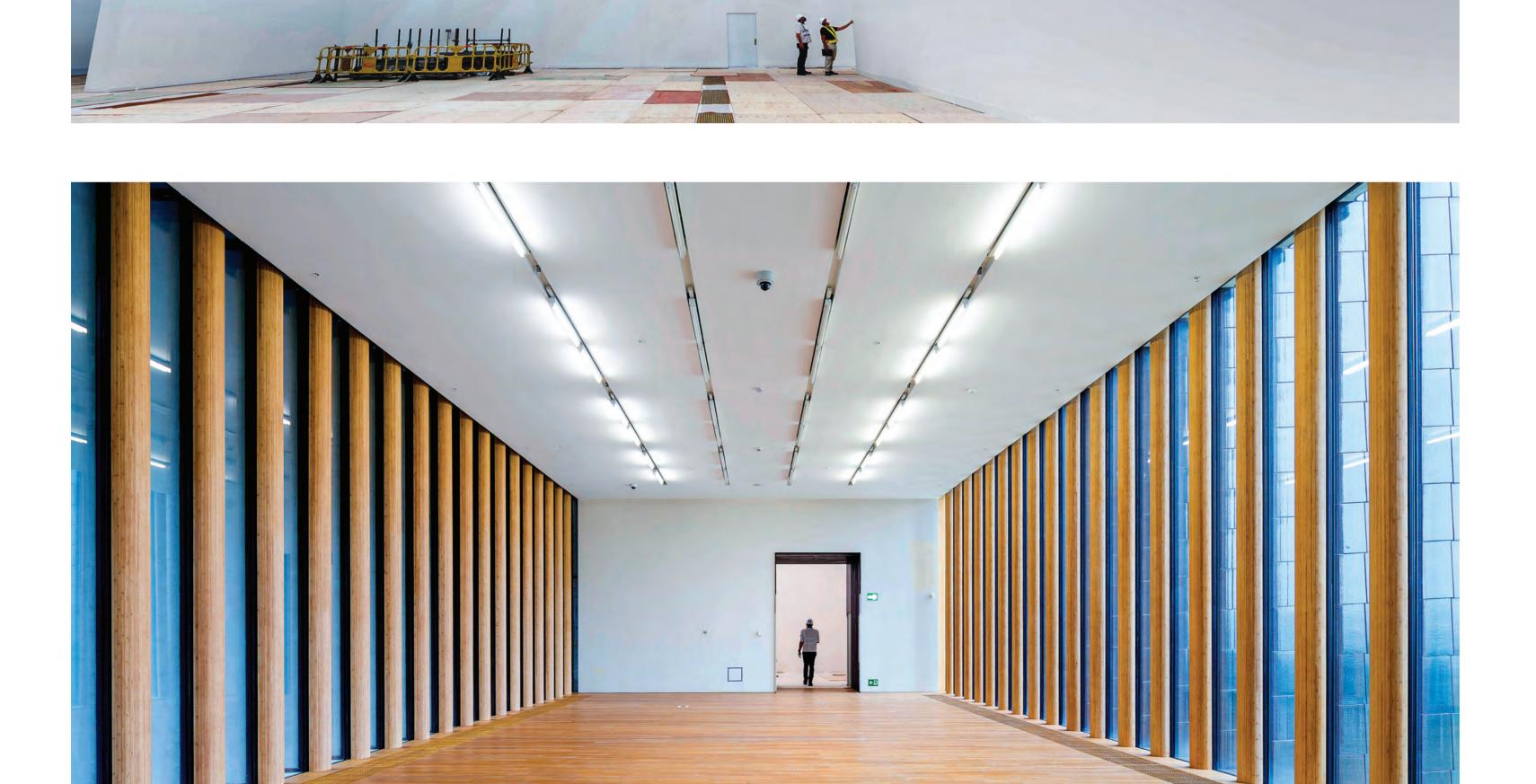
2



From the start, the project team insisted that the museum be built to the highest standards of quality. Accordingly, Gammon's construction team ensured that all mechanical, electrical and plumbing (MEP) services were fully integrated into the building and hidden from view. This was a particularly difficult technical challenge in such a large structure, especially since Gammon was not the original contractor:

Inside the ceilings and flooring of the gallery spaces is a hidden labyrinth of cables, pipes and sensors. These service the multimedia and wi-fi networks, extensive climatic and humidity controls, fire detection and alarm systems, and one of the most critical installations — the lighting for the galleries.

An advanced climate control system ensures the exhibition areas are kept cool and dry at all times, even during the hottest summer months when temperatures can reach more than 30 degrees Celsius and humidity often exceeds 90%. The buildings also have a natural passive design to temper the environment and maintain optimal comfort across all areas.



Above:

2/F Skylight Gallery Windows

The glass window panels measure 5 metres wide x 3 metres high and weigh up to 1.7 tonnes

Natural daylight is necessary for certain artworks and the use of skylights is an effective way to introduce this into the gallery. The 12 louvered skylights on the podium garden rooftop offer UV protection and also control the intensity and bleaching effects of sunlight directly shining onto the artworks inside, while providing unique illumination.

Belo

Customised Climate Controls for Art

Temperatures are maintained at 22-24 degrees Celsius and humidity at 50-60%

The museum's air-conditioning system maintains ambient temperatures and humidity at levels that ensure the preservation and integrity of the collections housed at M+.

From the Main Hall, visitors can easily access the M+ Shop, Grand Stair, cinemas and Learning Hub, as well as the Main Hall Gallery. Together, they provide a variety of welcoming spaces for visitors attending a scheduled event or anyone just wishing to spend a relaxing moment surrounded by exemplary visual culture.

Above

Public Accessibility

One of many multipurpose spaces

Access between the Roof Garden and ground floor is provided by the stepped profile of the Learning Hub mound and the outdoor escalator system. The mound also serves as a temporary stage for events, giving visitors the opportunity to look over the park or view the hanging wall garden.

Left:

Grand Stair

502 square metres

Grand in both name and nature, the amphitheatre offers stunning views of Victoria Harbour while admitting natural sunlight throughout the day. Once the sun goes down, a large high-definition screen comes out, transforming the space into an informal setting for screening films or hosting forums and corporate events.

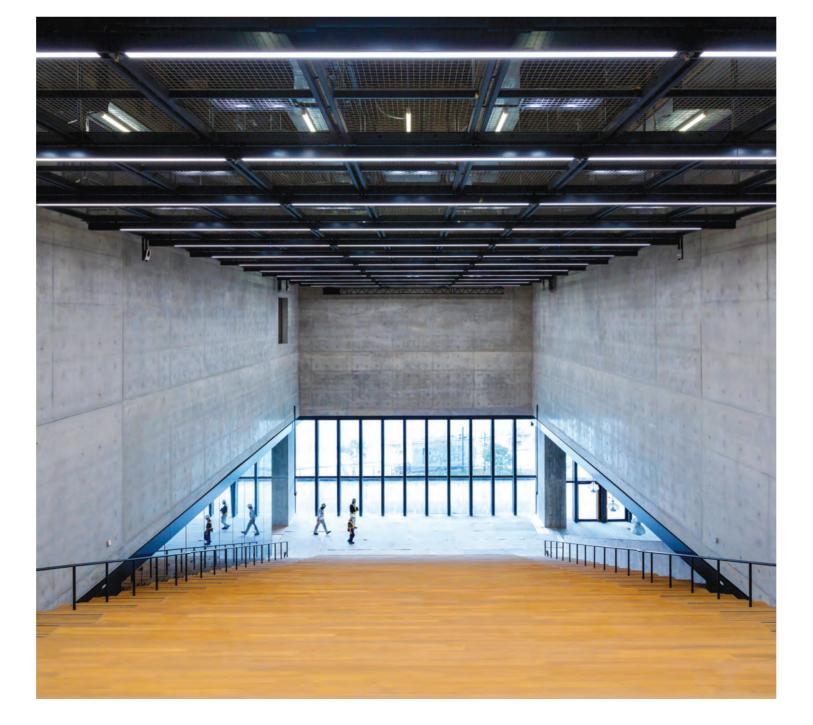
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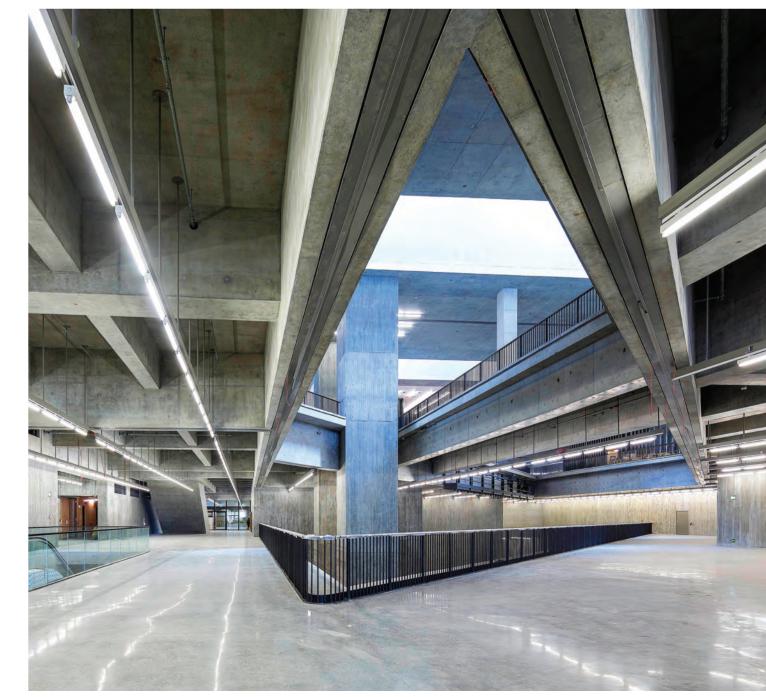
BI Lightwell Hall

Five interconnected floors with a total height of 32 metres

A diagonal floor opening affords a view onto the Found Space below, while large ceiling cut-outs allow visitors to see the second floor and its intersection with the tower above and supporting long-span trusses. The open skies outside M+ are visible in the Main Hall through skylights that run parallel to the tower.



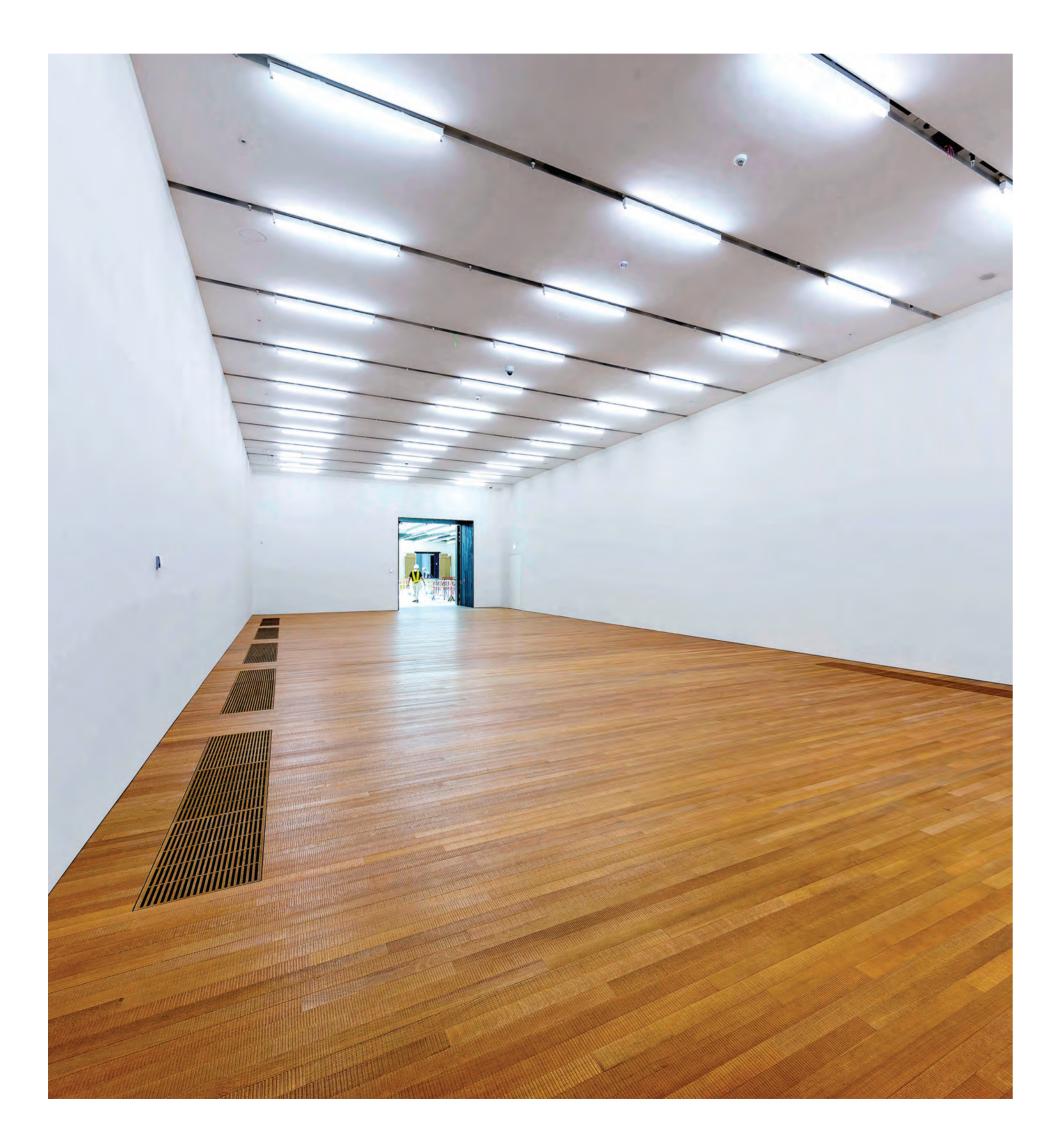




25

45 metres x 10 metres

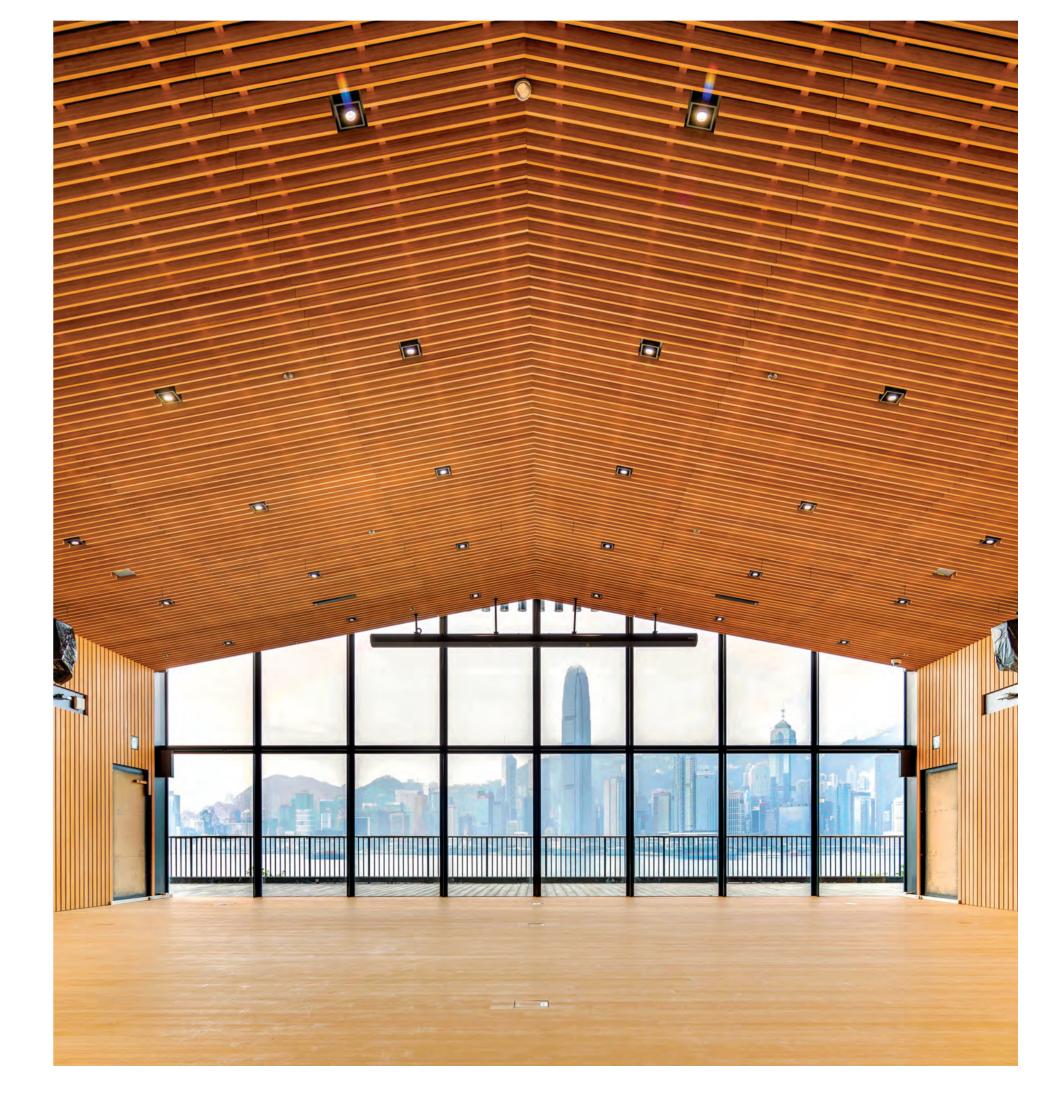
The exacting flatness tolerances of the acoustic ceilings within the galleries were a particular challenge for Gammon's artisans and engineers.

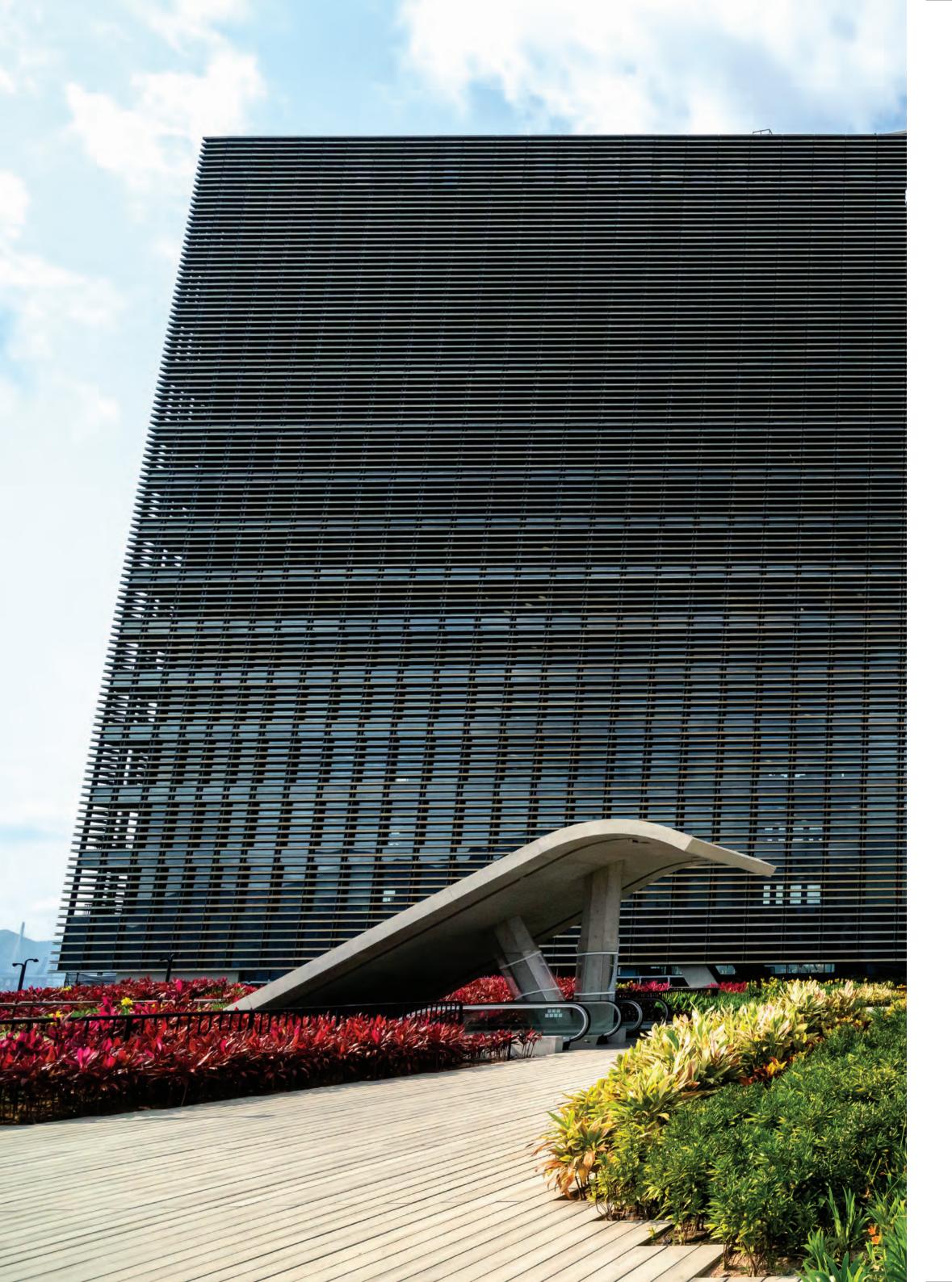


Learning Hub

The Forum 14.5 metres x 13 metres

The Learning Hub provides warm and inviting spaces lined with oak and bamboo finishes, where visitors can participate in programmes such as workshops, talks, performances, and pop-up events.





M+ Facade ED Screen

The vertical extension of the M+ building is centred on the horizontal slab of the podium, with the supporting mega-trusses partially visible beneath the ceramic facade. The two elements form a single entity, fused into the shape of an inverted "T".

Built to the maximum height permitted by the master plan, this slender vertical structure provides such facilities as a Research Centre and museum offices where natural filtered daylight and expansive city views make researching, learning and working a special experience. The M+ Lounge with panoramic views is housed on its upper floors.

M+ is also distinguished by its narrow profile of just 11.7 metres. Yet at the same time, it feels remarkably spacious due to the expansive windows that flood the interior with natural daylight. Even more striking is the massive LED screen integrated into the M+ Facade, which is an artistic platform for the curators. The screen displays works from the M+ Collection, commissioned artworks, museum messages and branding animations.

M+ 大樓幕牆上的 LED 屏幕

M+ 大樓垂直聳立於橫向基座平台上, 由巨型 桁架支撐的結構部分可見, 與當中的展覽空間 形成獨特的倒 T 形結構。

M+ 大樓的垂直結構, 高度定於總體規劃的限制範圍, 提供研究中心和辦公室等設施。 設於較高樓層的 M+ 會館, 風景盡覽無遺。

M+ 側面僅闊11.7米, 它的設計提供大量窗戶, 讓自然光透進室內空間, 使大樓的空間更廣闊。置於 M+ 幕牆上的巨型 LED 屏幕, 是策展人的流動影像平台, 用於展示 M+ 藏品、委約作品、博物館訊息, 以及 M+ 品牌動畫, 讓人感到震撼。





DfMA Construction

A project as complex as M+ demands that all logistical work be well coordinated, with as many components assembled off site as possible, as well as the appropriate application of leading-edge technology to ensure assembly is efficient, cost effective and safe.

This approach, known as design for manufacture and assembly (DfMA), is a speciality of Gammon, as evidenced by many of the company's recent projects in Hong Kong.

To ensure materials and building components were manufactured and assembled to the client's high standards of quality, Gammon made extensive use of DfMA during the course of construction, as well as technologies such as building information modelling (BIM), 3D scanning and radio frequency identification in the design, planning and logistical management of the project.

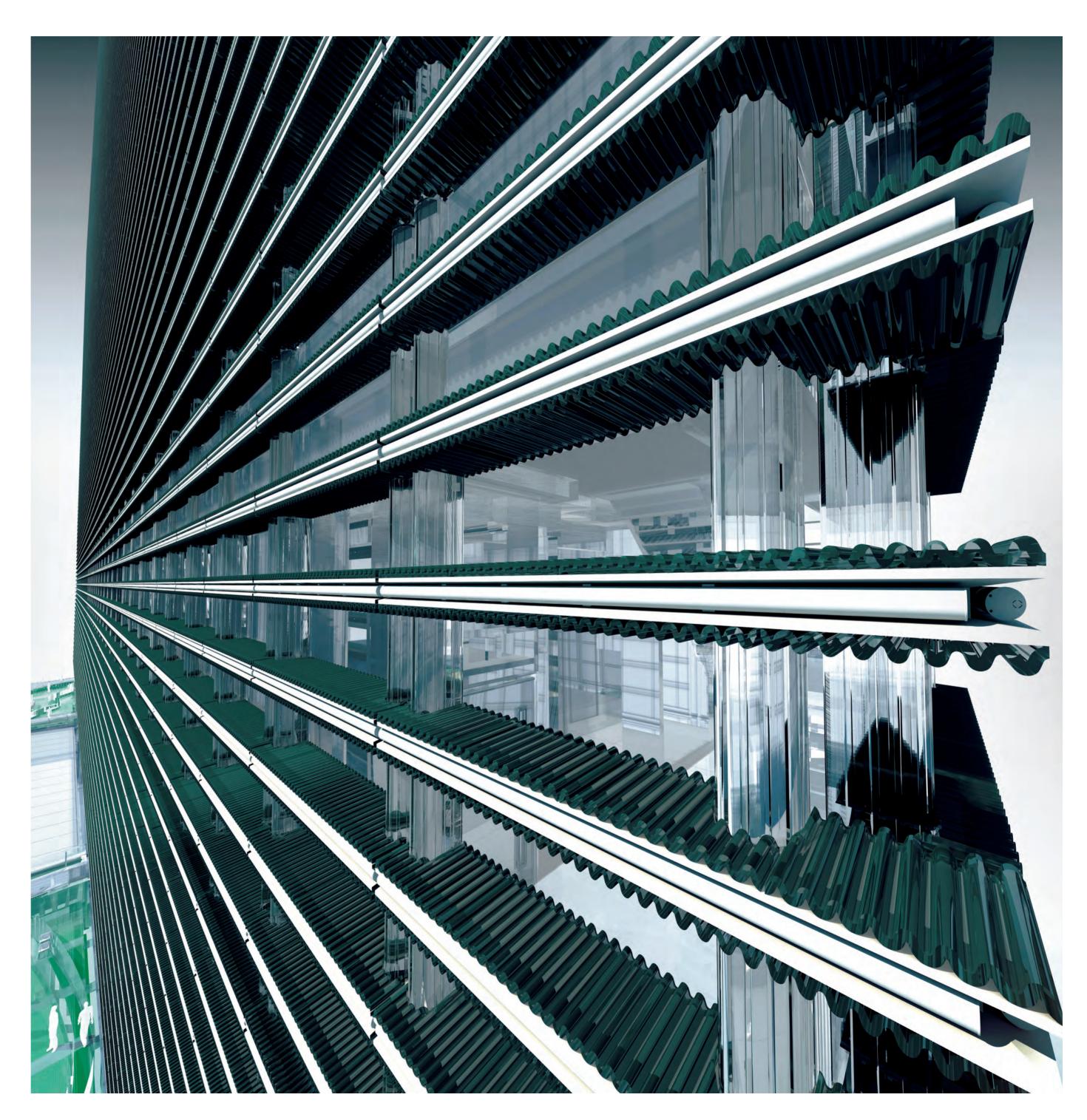
Each component that makes up the facade — the terracotta panels, unitised curtain wall units, spandrels and parts for the LED system — was manufactured off site and delivered to the project in a modular form and ready for assembly. Gammon's logistics team, using sophisticated planning tools, arranged an average of four deliveries per day on flatbed lorries to the site, where components took from 30 to 45 minutes to be lifted by crane and fitted into position. On a good day, with weather permitting, around 12 units could be installed.

From Italy to Hong Kong

The museum's signature grey-green glazed terracotta tiles cover 14,882 square metres of the M+ Facade. Each prefabricated module measures 6 metres x 10 metres and weighs between 3.5 and 7 tonnes.

During construction, thousands of these terracotta tile panels were manufactured in Florence, Italy and shipped to mainland China, where they were assembled into pre-cast moulds and formed into 1,590 modular units.

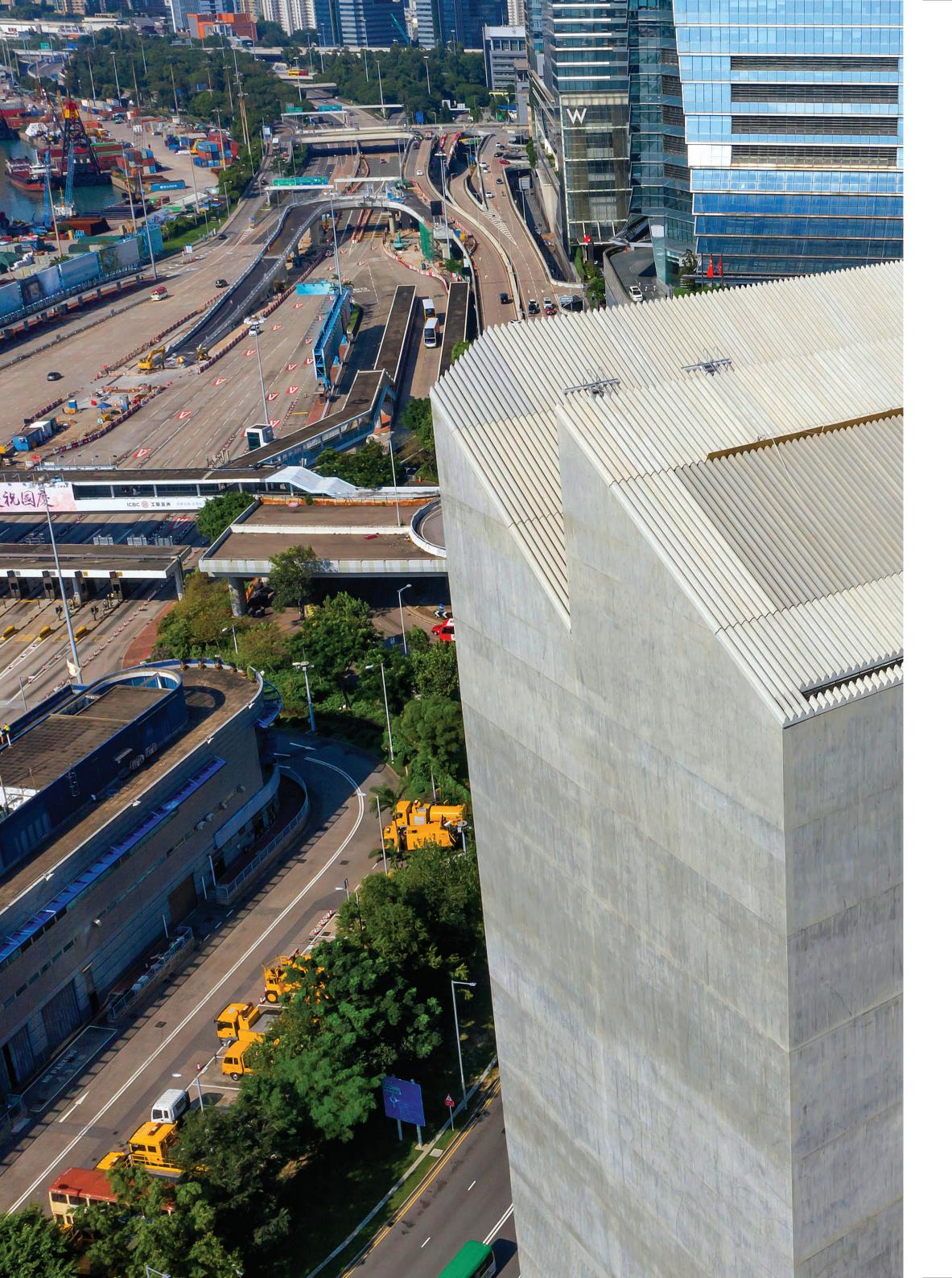












Innovation Management

Located next to the main M+ building, a Conservation and Storage Facility has been constructed for M+'s growing collection of visual culture.

After taking-over the M+ project, the Gammon team focused on constructing a safe and accessible environment for the delivery, storage, preservation and installation of the museum's collection. In addition to the building itself, the works included gas-based fire prevention systems, specialist conservation laboratories and storage racks, as well as facilities for rare books and a curators' studio.

創新+管理

毗鄰 M+ 大樓的是修復保管中心, 為 M+ 與日俱增的視覺文化藏品而建。

金門團隊在接管 M+ 項目後, 為運送、儲存、 保護和裝置館藏, 投入建立安全和易於存取 的環境。除了興建建築物本身, 金門亦負責 建設氣體防火系統, 專業修復實驗室和 儲存架, 以及罕有書籍設施和工作室。





New Technologies

Traditionally, Gammon would manage a project by appointing a single manager to supervise all the construction activities.

However, on M+ this would not have been an ideal approach given the amount and scale of work that had to be done each day. Instead, Gammon assigned 11 managers to take responsibility for integrating the E&M, fit-out, civil works, the facade and commercial support, each in their own area.

Gammon is well known for its application of advanced construction technology on its projects, and the M+ was no exception. What Gammon terms "integrated digital project delivery" (or IDPD) is at the heart of this approach. Using BIM, Gammon has taken this technology from its current application for generating 3D models to project planning in 4D for more efficient progress tracking and decision-making.

Other tools harnessed by IDPD included lasers and drone data clouds, communication platforms, IoT sensors and augmented reality for the concealed mechanical, electrical, plumbing and fire services systems.

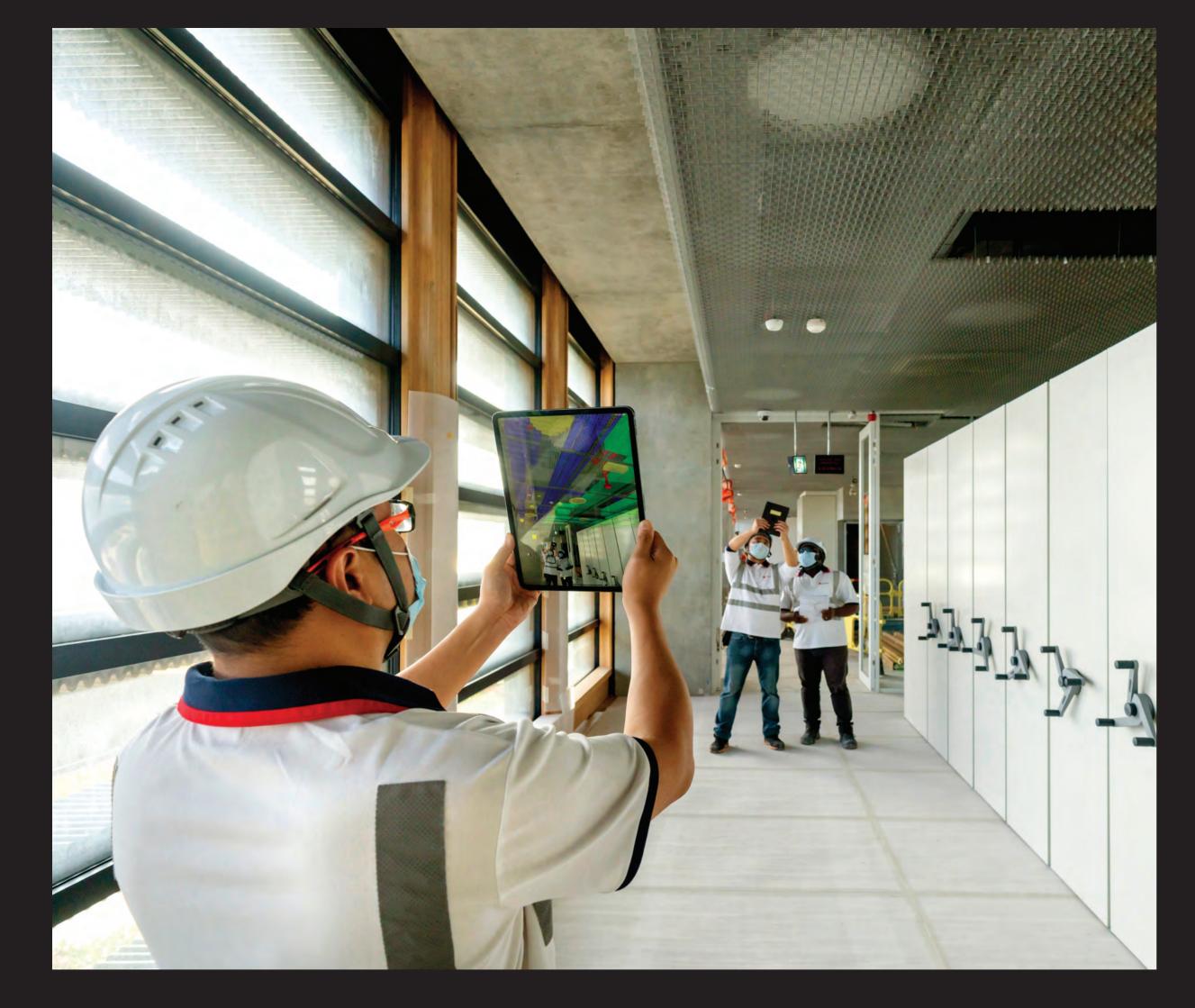
To ensure the participation of all project team members, Gammon developed a common data environment (CDE) platform to link BIM with smartphone-based on-site visualisation tools as well as other project management platforms. This meant users who might not be familiar with BIM, such as site foremen, could benefit from the CDE platform's ability to keep track of changes and identify defects in a simple and highly visual manner.

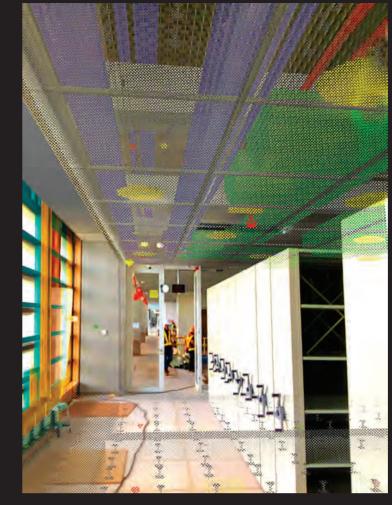
Building Information Modelling (BIM)

Gammon's BIM division and on-site teams joined together to manage and update design and construction progress on the M+ building. The work of the BIM team was especially critical for updating designs and rectifying potential clashes in the extensive MEP systems throughout the project.

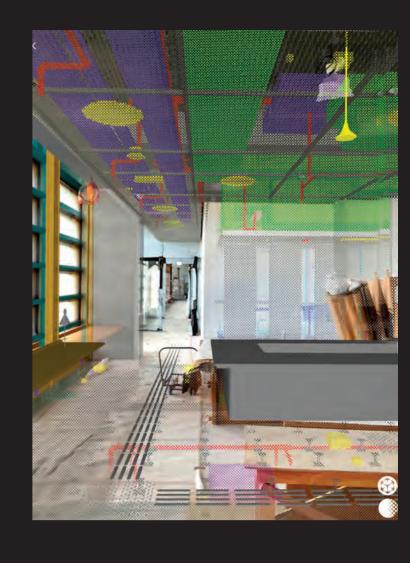


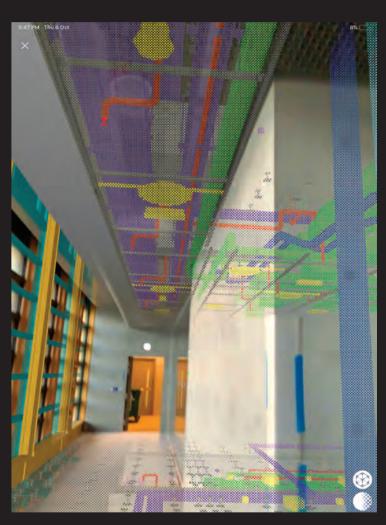












Augmented Reality

Augmented reality was employed to aid construction planning and progress tracking. Unlike virtual reality, which completely immerses a user in an imaginary world, augmented reality provides a live view of the real world with additional digital elements for planning and progress tracking.

For the M+ project, members of the Gammon project team used mobile tablet devices equipped with an embedded vision tracking algorithm to detect changes in the position of known elements, such as columns and walls, in the augmented reality model and the actual project site. As a result, changes could be detected immediately, allowing team members to collaborate in real time.

New Gammon Technologie

Augmented reality for planning and progress tracking

Augmented reality was particularly useful as an aid for engineers working on the concealed mechanical, electrical, plumbing and fire services installations.





Green Sustainable

Accessibility is a key criteria for the design of the M+ and significant effort was made to ensure the building is suitable for everyone. The M+ project has always adhered to the highest construction standards and has brought a safe, functional, environmentally friendly and energy-saving museum building to the public. The M+ building and Conservation and Storage Facility were awarded BEAM Plus Gold certification by the Hong Kong Green Building Council.

Located facing the waterfront promenade of the Art Park in the West Kowloon Cultural District, M+ takes advantage of the unique setting with its panoramic views of Victoria Harbour and Hong Kong Island's iconic skyline. The Roof Garden on the third floor of the museum building has also been planted with a wide variety of species, providing a visitor-friendly environment adjacent to the concrete structures that surround it.

Inclusivity is another key feature of the M+ project, as provisions for the less able have been provided throughout the building including access for non-ambulant visitors. The nearby Artist Square Bridge is strategically located to provide convenient access to all facilities and offers pedestrians a direct, 24/7, barrier-free connection between the District's Artist Square and developments above MTR Kowloon Station.

綠色+可持續發展

通達方便是 M+ 設計的一個關鍵原則,致力確保建築物適合任何人。M+ 全面的可持續性建築項目,獲得香港綠色建築議會綠建環評最終金級認證——藏品對於室內環境的要求極高,這並非一項簡單的任務。

M+ 坐落於西九文化區面向藝術公園的海濱 長廊, 飽覽維多利亞港全景和香港島的 天際線。博物館大樓在三樓天台花園栽種 多種植物, 在混凝土結構的映襯下, 為訪客 提供怡人的休憩環境。





Sustainable Construction

According to Gammon, one of the reasons it was selected to oversee the M+ project was its long experience in sustainable building construction.

From the start, every aspect of the building's performance was taken into consideration, including a microclimate study to analyse the impact of the M+ project on the surrounding area. To minimise heat gain and lost cooling energy, sun shading devices were integrated into the architectural design allowing more natural light to be integrated into the building.

During construction, many regionally sourced (within 800km of Hong Kong) building materials were selected with the goal of reducing carbon emitted during transportation. Other sustainable materials included reused/recycled products, such as waste concrete and glass for concrete blocks, and FSC/PEFC certified timber for the temporary works.

Water-saving sanitary fittings in the completed building include WELS labelled water taps and the use of low VOC emitting building materials to meet stringent indoor air quality standards and reduce chemical interactions with artworks. Noise levels have also been minimised by isolating floors from the main museum structure, as well as installing raised floors and acoustic ceilings generally through the building.

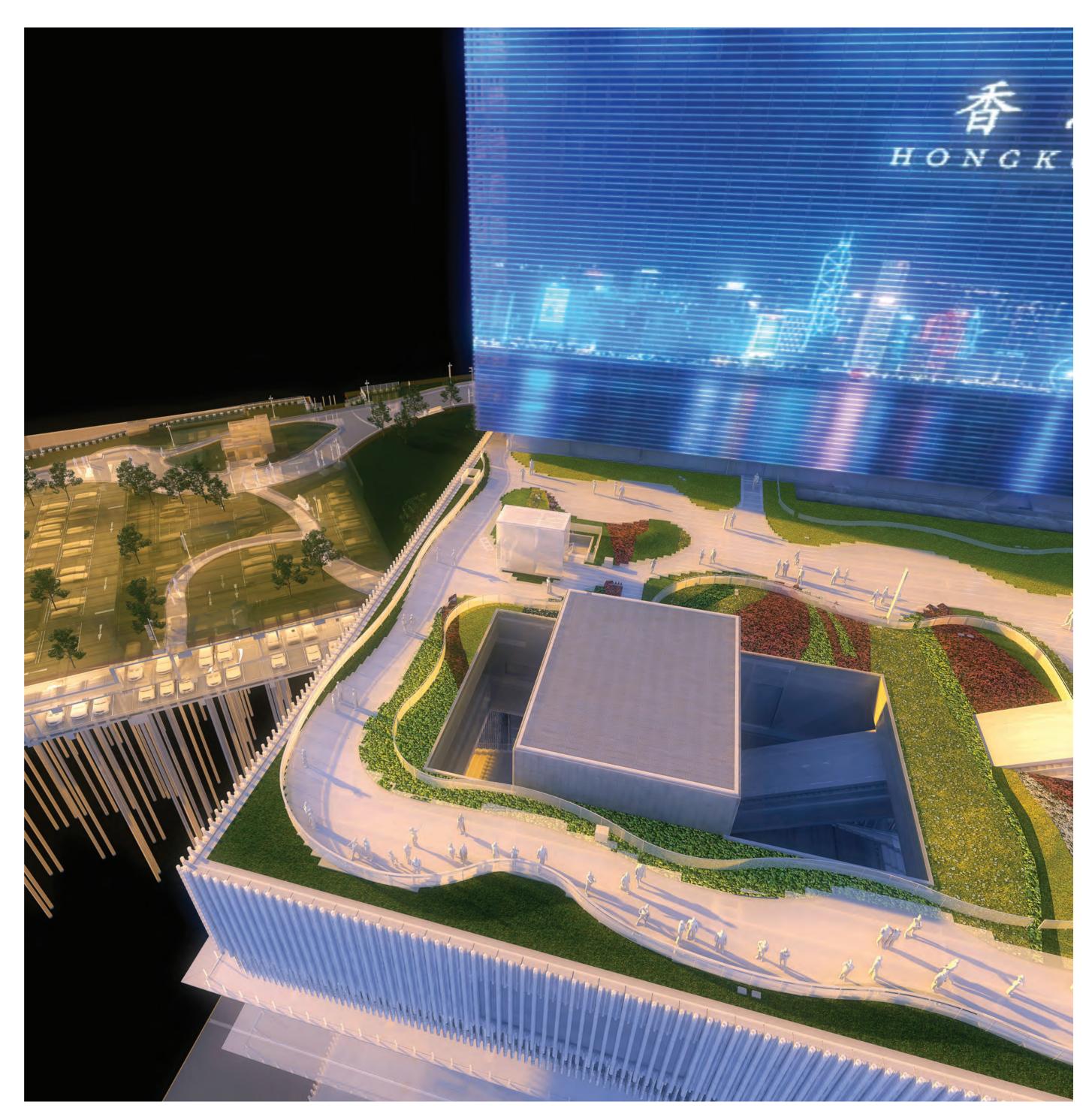
Roof Garden

Approximately 138,000 plants and shrubs have been planted

Plants are irrigated by underground drip pipes set into the soil. To conserve water and energy, a harvest system has been installed so that rainwater can be collected and reused for irrigating landscape features.



The Roof Garden, located on the third floor of the podium and overlooking Victoria Harbour, was created using a total of 3,300 cubic metres of soil that had to be lifted up 20 metres by crane. Approximately 138,000 plants and shrubs covering an area of 6,400 square metres are now located here.





Access + Connectivity

Gammon constructed some of the key infrastructure that connects Hong Kong, mainland China and the world to M+.

A three-level vehicular underpass provides additional road capacity in the West Kowloon area as well as access to M+ and other West Kowloon Cultural District venues and facilities. The integrated basement under the Lyric Theatre Complex, which is under construction by Gammon, houses an underground public road network that gives vehicles unrivalled connectivity between M+ and other arts and cultural facilities.

Local and regional rail users can visit M+ via the nearby MTR Austin Station and Hong Kong West Kowloon Station high speed rail terminus, both of which were also constructed by Gammon, as well as MTR Kowloon Station. Six footbridges and two subways link Hong Kong West Kowloon Station to neighbouring areas, the Elements shopping mall and the West Kowloon Cultural District.

Aerial View of M+ and the West Kowloon Cultural District

Diverting traffic to M+ underground through the underpass provides more space at ground level for pedestrians and cyclists, as well as a cleaner, quieter and safer environment for the public with large areas of open space.

Along the harbourfront, an uninterrupted two-kilometre waterfront promenade of the Art Park gives the people of Hong Kong a new and distinctive view of the city's iconic skyline.





Artist Square Bridge

Under a separate contract, Gammon completed the design and constructed the Artist Square Bridge, which forms the main pedestrian route to M+ and the West Kowloon Cultural District.

As the bridge traverses nine lanes of traffic and crosses above the MTR tunnels, there were limits as to where the temporary supports could be placed. The solution was to use an innovative push launching method from the Artist Square site. During construction, the project team took delivery of I I large steel segments, which arrived from Gammon's fabrication yard by sea, and assembled them on site. The team progressively pushed the bridge southwards, adding segments one by one while maintaining stability at all times. The bridge structure was subsequently launched northwards across Austin Road West at night into its final position bearing upon the Elements shopping complex, linking the project and its rail facilities to the West Kowloon Cultural District.

Assembly and launching were completed in July 2021, and the bridge opened to the public in December 2021.

Artist Square Bridge

A 570-tonne steel structure, with a clear span of 73 metres consisting of seven prefabricated truss modules and seven prefabricated arch segments.

Artist Square Bridge, an elegantly designed footbridge with a wide deck and high curved roof, forms a gateway to M+ and the West Kowloon Cultural District as well as a visual complement to M+ and other facilities.



Creating the **M+ Building**