



Lighting

**ARUP**



Cover image: Paradeigma, Art Installation for darc night, London, UK  
Photography © monobarc / darc magazine

Inside cover image: Fulton Centre, New York, USA  
Photography © James Ewing

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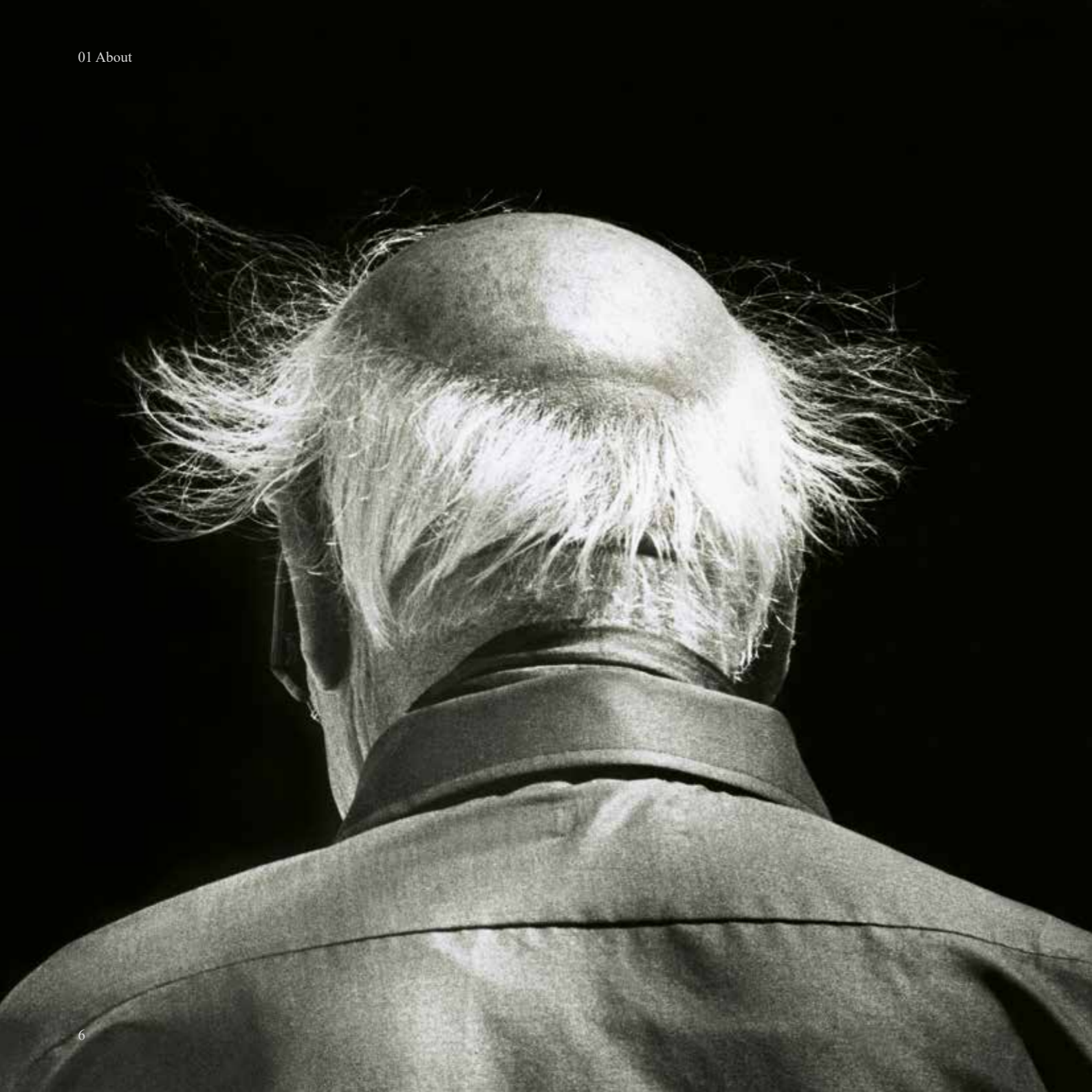
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# 01 About

Mathematics - The Winton Gallery Science Museum  
London, UK

Photography © Arup


In skilled hands, lighting enhances,  
sculpts and inspires



“The term ‘Total Architecture’ implies that all relevant design decisions have been considered together and have been integrated into a whole by a well organised team empowered to fix priorities.

This is an ideal which can never — or only very rarely — be fully realised in practice, but which is well worth striving for, for artistic wholeness or excellence depends on it, and for our own sake we need the stimulation produced by excellence.”

Sir Ove Arup, Arup founder



Lighting is the fourth  
dimension of architecture,  
integrating with and enhancing  
the other design disciplines.  
Arup's lighting studio provides  
a comprehensive architectural  
lighting design service to  
clients around the world.

Musée du Louvre-Lens  
Lens, France

Photography © Hisao Suzuki



## A global team of specialists

From initial strategic advice and concept development all the way through to construction documents and on-site support, our work can be characterised as engaged and involved, with a strong emphasis on creativity that we combine with the technical excellence for which Arup is famous. Our team comprises designers with various specialisms such as daylight design, fixture design, brand identity and lighting engineering.



California Academy of Sciences  
San Francisco, California, USA  
Photography © Tim Griffith

## 24 hour design

Our human-forward and experiential approach in the design of lighting follows the fundamentals of high quality user experience and well-being. Our holistic approach from day to night-time design allows us to contribute to the UNSDG goals and AIA's 2030 and 2050 goals to plan for a reduction in carbon footprint and push the industry towards a more creative approach in sustainability of materials and luminaire life-cycle.

## Conceptual design, technical detail

Our team works closely with architects at all stages of a project, our lighting specialists remain at the forefront of the industry, providing original and authentic conceptual designs. Uniquely well-placed to turn vision into reality, we transform creative concepts into detailed technical specification.

## Daylight philosophy

Great lighting design also relies on using natural light effectively. Arup's lighting studio is a market leader in daylight design. Our specialists work with architects to understand how natural light is distributed through building geometries, and how it reflects and diverts in different colours and materials. Together, we use this to enhance a building's performance and aesthetics.

## Hands-on philosophy

With the potential to change how we perceive architecture and public space, our lighting teams across the globe are experts in designing with smart envelopes, chip-based lighting equipment and media façades. We explore the synthesis of light, media and scientific ambition. Our current project base highlights a number of world-class examples of the application of Arup's trademark innovation.

SeaChange  
Vancouver, British Columbia, Canada

Artist: Jill Anholt Studio Lighting

Design for waterfront underpass.

Photography © Nic Lehoux



# 02 Inspiration

Dongdaemun World  
Design Park and Complex  
Seoul, South Korea

Photography © Sun Namgoong

In architecture, light directs, sculpts,  
enriches, and gives people a comfortable,  
safe and inspiring environment



## Light is the source of everything on earth

“Most lighting firms lean towards either being technically or artistically inclined, but not both. Arup demonstrates a thorough knowledge of the technical aspects of lighting design while maintaining a creative approach.”

Antoine Chaaya, Partner, Renzo Piano Building Workshop

The Quest: Hennessy Paradis Imperial  
Paris, France

Kinetic light sculpture

Photography © Marshmellow Laser Feast





**The National Music Centre  
Calgary, Alberta, Canada**

Architect: Allied Works Architecture

Canada's National Music Centre is a 130,000ft<sup>2</sup> space dedicated to showcasing Canada's rich musical culture. The centre offers spaces for music education, performance, recording and exhibitions. Arup's exterior lighting design accentuates the building's unique curved form while also maximizing energy efficiency. The interior design scheme prioritises the use of natural light. Advanced controls were used to optimise performance and efficiency.

Photography © MIR



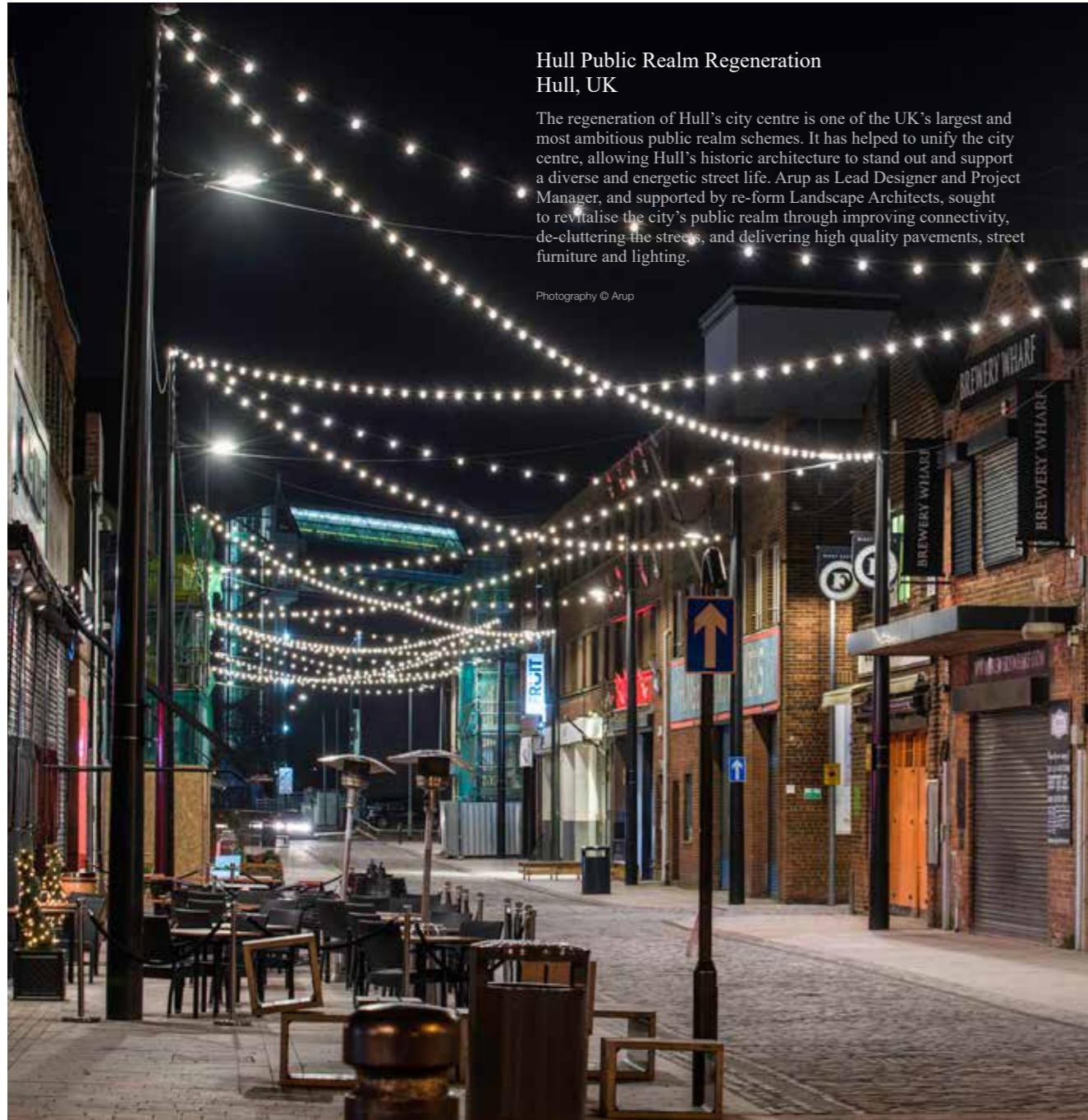


### 101 Collins Spire Melbourne, Australia

Visible from all directions, the spire of 101 Collins Street is a Melbourne city landmark that lights up the night sky with a choreographed light display made from 700m of linear LEDs moving in a sequence of rich hues and intensities. Swirls of colour inspired by the building's internal finishes gently envelope the spire platforms and perimeter of the upper building and touch down onto the buttress. As creative and technical leads of the lighting installation, Arup executed the design from conceptual thinking through construction and commissioning. Through stakeholder workshops, Arup's lighting team helped the client share some of the local stories, history of the iconic building and its important position on the city skyline.

Photography © Jessie Obialor; Papermill Media





### Hull Public Realm Regeneration Hull, UK

The regeneration of Hull's city centre is one of the UK's largest and most ambitious public realm schemes. It has helped to unify the city centre, allowing Hull's historic architecture to stand out and support a diverse and energetic street life. Arup as Lead Designer and Project Manager, and supported by re-form Landscape Architects, sought to revitalise the city's public realm through improving connectivity, de-cluttering the streets, and delivering high quality pavements, street furniture and lighting.

Photography © Arup





### Fulton Center New York, New York, USA

Architect: Nicholas Grimshaw & Partners

The Fulton Centre in lower Manhattan consolidates six stations and 10 separate subway lines under one roof. Serving more than 300,000 passengers each week day, the Fulton Centre is a major transit hub. The incorporation of daylight and other lighting sources were key priorities for the project. The station's most prominent feature is a steel and glass atrium featuring "the Sky-Reflector Net" – an oculus of cables and reflective panels. The Net was optically-designed and located to allow direct natural light to penetrate the two levels below ground. Hidden electric lighting provides additional illumination. Subtle lighting is used on the exterior to further highlight the dome.

Photography © James Ewing; Arup

# 03 Arts

Musée du Louvre-Lens  
Lens, France

Photography © Iwan Baan

In the theatre, light creates a scene's  
suspense, romance, excitement or fear.

We are inspired by the performing arts, and Arup's lighting design studio can bring theatrical or musical experience to your project.

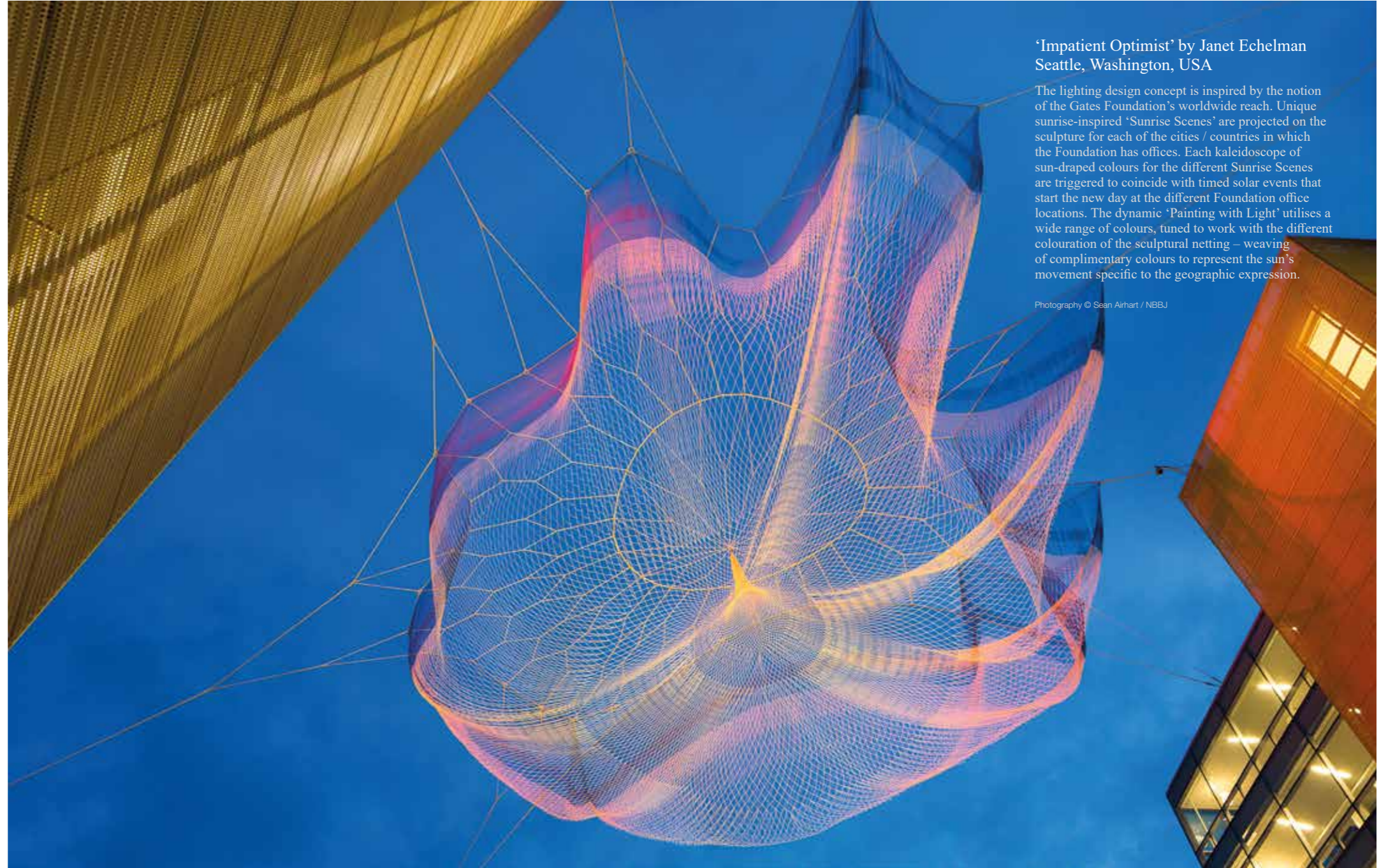
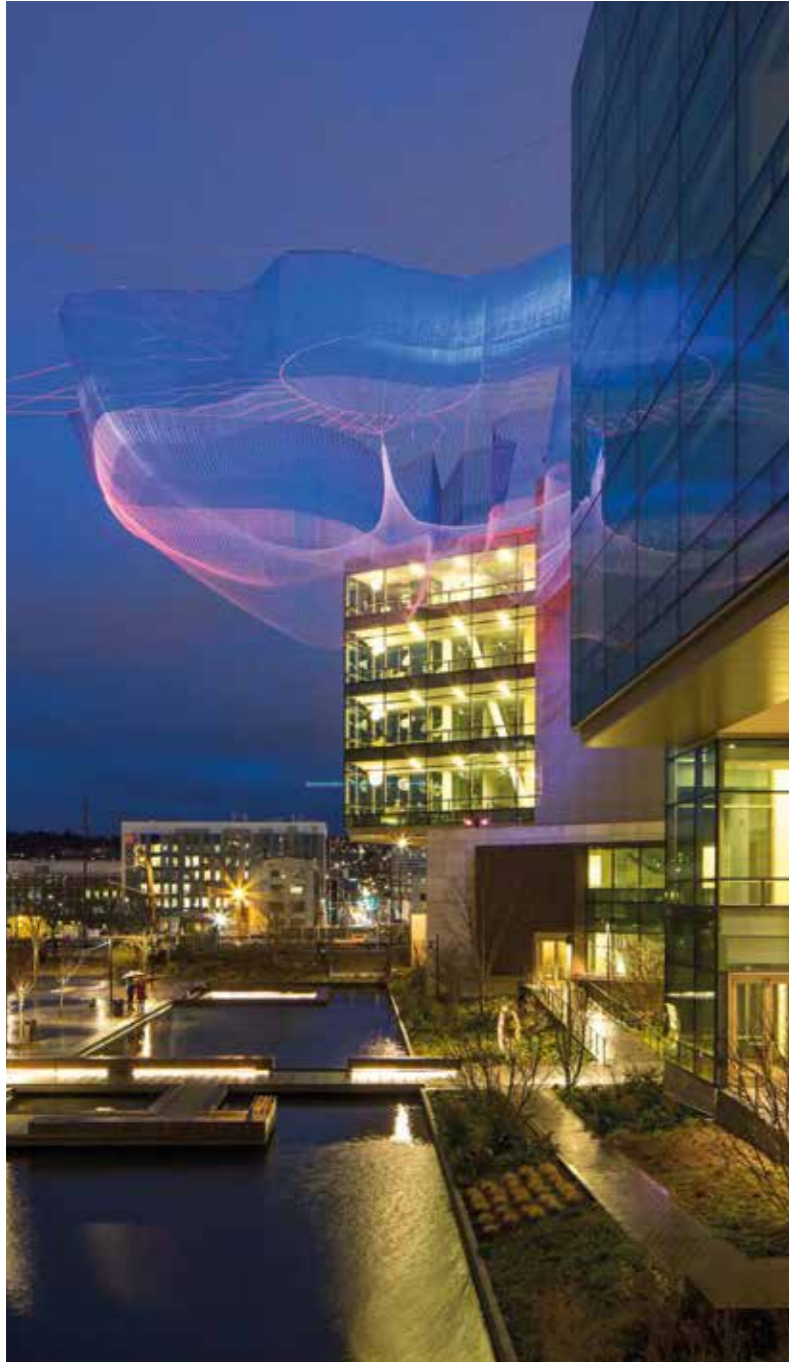
Lighting designers are sculptors, painters and authors all at the same time. Many of our clients employ light as an artistic component in their architecture, and use light to differentiate their appearance in the market.



UP, and away!  
Traveling globally

Light art creation

Photography © Vellachi Ganesan

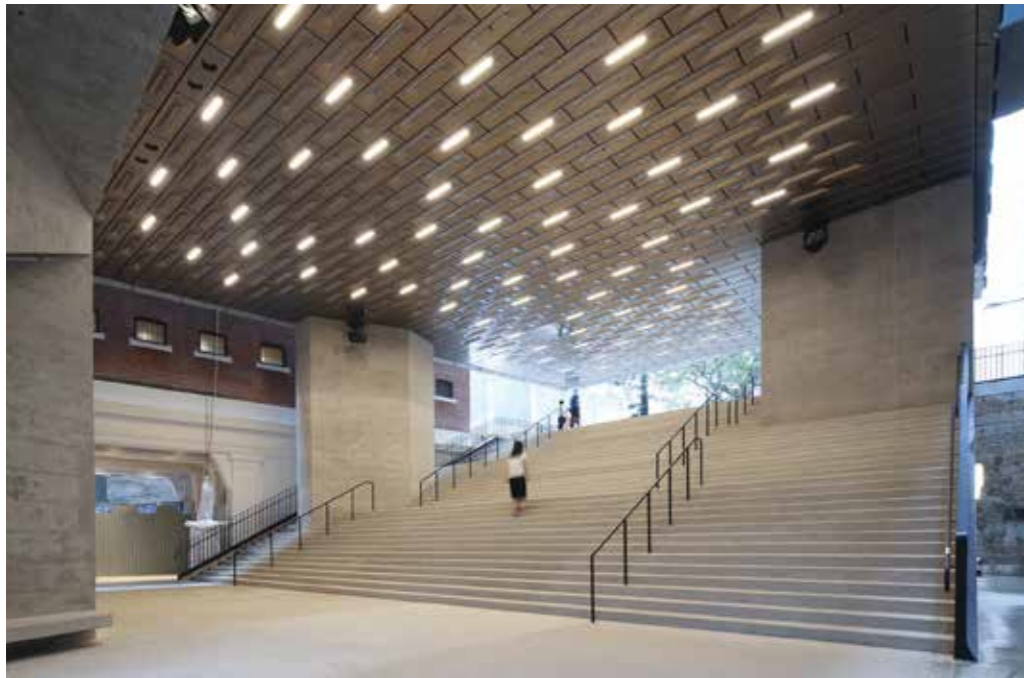


**'Impatient Optimist' by Janet Echelman**  
Seattle, Washington, USA

The lighting design concept is inspired by the notion of the Gates Foundation's worldwide reach. Unique sunrise-inspired 'Sunrise Scenes' are projected on the sculpture for each of the cities / countries in which the Foundation has offices. Each kaleidoscope of sun-draped colours for the different Sunrise Scenes are triggered to coincide with timed solar events that start the new day at the different Foundation office locations. The dynamic 'Painting with Light' utilises a wide range of colours, tuned to work with the different colouration of the sculptural netting – weaving of complimentary colours to represent the sun's movement specific to the geographic expression.

Photography © Sean Airhart / NBBJ





Tai Kwun - Centre for Heritage and Arts  
Hong Kong, China

Architect: Herzog & de Meuron

Tai Kwun – Centre for Heritage and Arts is Hong Kong’s largest ever historic building revitalisation project, transforming the city’s former Central Police Station compound, with its 170 years of history, into a new art and cultural centre. Our lighting design for Tai Kwun is intrinsically integrated with the architecture and finishes to help weave together the various forms and spaces.

Photography © Arup; Herzog and De Meuron / Iwan Baan



Clyfford Still Museum  
Denver, Colorado, USA

Architect: Allied Works Architecture

The Clyfford Still Museum was built to showcase the work of the famed abstract expressionist for which it is named. The museum was designed to embody Still's unique artistic sensibilities. The design integrates a mix of fluid daylight, dark space, and craggy surfaces to produce a distinct and dynamic visitor experience. To ensure optimal conservation conditions, light transmission and penetration are carefully controlled.

Photography © Jeremy Bitterman





## Museum Folkwang Essen, Germany

Architect: David Chipperfield Architects

Museum Folkwang is a major collection of 19th and 20th century art in Essen, Germany. The museum was established in 1922. In 2007, David Chipperfield designed an extension, which was built onto the older building. The exhibition spaces are lit primarily by daylight. The use of artificial lighting is reduced to a minimum, and generally takes place only on the cloudiest of days and after dark. All rooms in the permanent collection are supplied with natural light by a central skylight. The four vertical surfaces within the skylight are made of frosted glass and are equipped with electric sun blinds. These sun protection elements block unnecessary light when the museum is closed and regulate the use of natural light during opening hours.

Photography © Hulfton + Crow



## Corning Museum of Glass Expansion Corning, New York, USA

Architect: Thomas Phifer and Partners

The new wing at the Corning Museum of Glass is the largest space in the world devoted to the display and creation of contemporary art and design in glass. Lighting was a key driver in the architectural design, and the unique qualities of glass allowed for more flexibility and innovation than a typical art viewing space. The glass roof consists of a pattern of clear, diffuse, and opaque panels that allow abundant levels of daylight to filter down through a concrete beam system which tempers the daylight, shields the view to the skylights, and pushes light downward onto the glass sculptures. The ceiling system also includes ambient uplighting for general illumination at night, and lighting tracks with spotlights on custom pendants to highlight art.

Photography © Iwan Baan





Rijksmuseum  
Amsterdam, The Netherlands

Architect: Cruz y Ortis

The Rijksmuseum is the Netherlands' national museum dedicated to arts and history in Amsterdam. The renovation of the Rijksmuseum consisted of a complete overhaul of all existing heritage protected spaces. Gallery spaces and the famous courtyard make use of daylight and the electric lighting has been designed to create an engaging museum experience.

Photography © Iwan Baan and Vincent Menzel



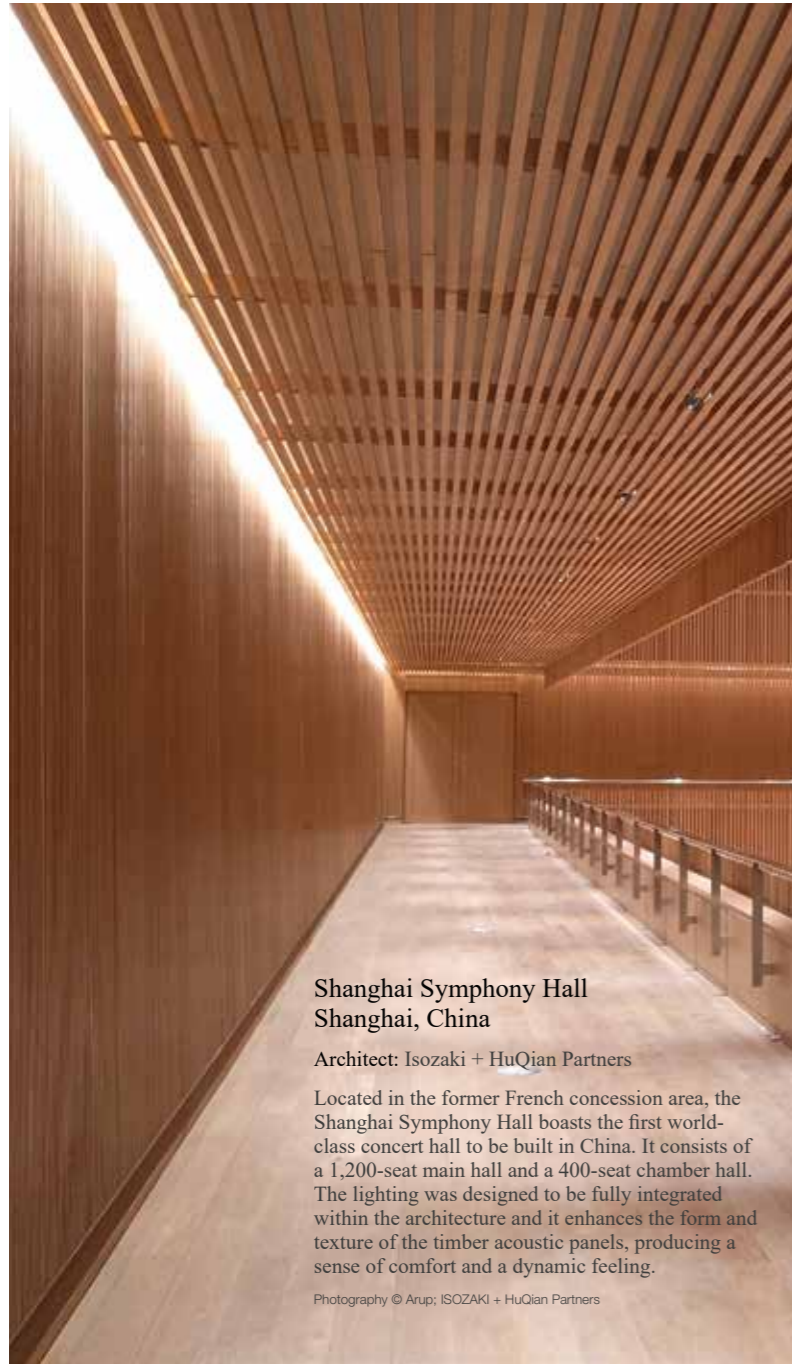
**San Francisco Museum of Modern Art (SFMoMA)**  
San Francisco, California, USA

**Architect:** Snøhetta and EHDD Architects

The new 235,000ft<sup>2</sup> SFMoMa extension houses galleries, public spaces and a special area dedicated to the Fisher Collection of contemporary art. Arup worked closely with the building's architects to achieve an ambitious lighting scheme. The expansion's dynamic façade subtly transforms as natural light fades throughout the day and is replaced by carefully-selected electric lighting. The City Galleries at the front of the building, showcasing interactive and less light-sensitive work, provide ample natural lighting and visual connections to the city and sky. As visitors move up the building, the lighting is designed to promote organic flow between circulation spaces and rest areas. Carefully-sculpted ceilings in the gallery spaces produce a "naturally-lit" effect.

Photography © Jeff Goldberg





### Shanghai Symphony Hall Shanghai, China

Architect: Isozaki + HuQian Partners

Located in the former French concession area, the Shanghai Symphony Hall boasts the first world-class concert hall to be built in China. It consists of a 1,200-seat main hall and a 400-seat chamber hall. The lighting was designed to be fully integrated within the architecture and it enhances the form and texture of the timber acoustic panels, producing a sense of comfort and a dynamic feeling.

Photography © Arup; ISOZAKI + HuQian Partners



# 04 Stewardship

Columbia University Manhattanville  
New York, New York, USA

Architect: Renzo Piano Building Workshop

Photography © Frank Oudeman/OTTO

Stewardship of light through circular lighting principals and energy targeting are at the core of our design solutions for sustainable development.

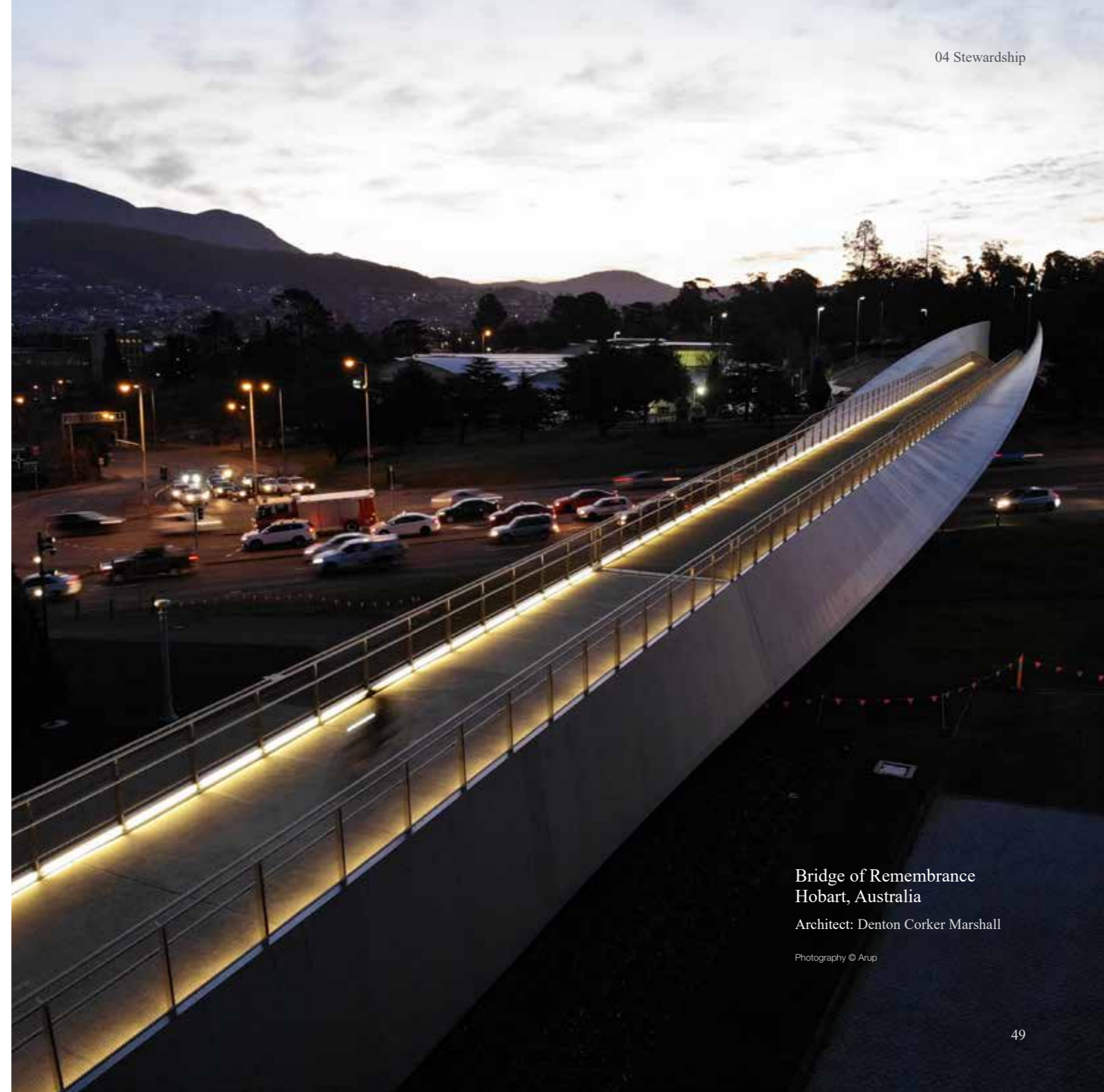




We're pioneering new approaches like circular design principles, to increase the design-for-reuse and recycling in large scale lighting projects. We deliver a lighting design that embraces the human spirit have a holistic approach to sustainable design.

“When we try to pick out anything by itself, we find it hitched to everything else in the Universe.”

John Muir



Bridge of Remembrance  
Hobart, Australia  
Architect: Denton Corker Marshall

Photography © Arup



## Al Bahr Towers Abu Dhabi, UAE

Architect: Aedas

The brief from the client was to produce an “outstanding landmark building” that considered the region’s architectural and cultural heritage. The response to this is the unique, dynamic “Mashrabiya” shading element that forms the project’s most distinctive feature. Our lighting designers worked closely with the design team to produce a shading system that carefully balances the needs for solar shading, glare control and transparency. The result is an interior office environment where daylight provides the primary source of light. Electric lighting in all areas of the project is sensitively integrated within the architecture.

Photography © Peter Chipchase



**BBC TV Studios  
London, UK**

This project is the first step in increasing the energy efficiency of the lighting of television productions. Essentially this piece of work is about paving the way to change behaviour: raising awareness of low energy lighting technology options amongst program makers, but also encouraging manufacturers to consider what program makers need.

Photography © Arup

## King's Cross Station London, UK

Architect: John McAslan + Partners

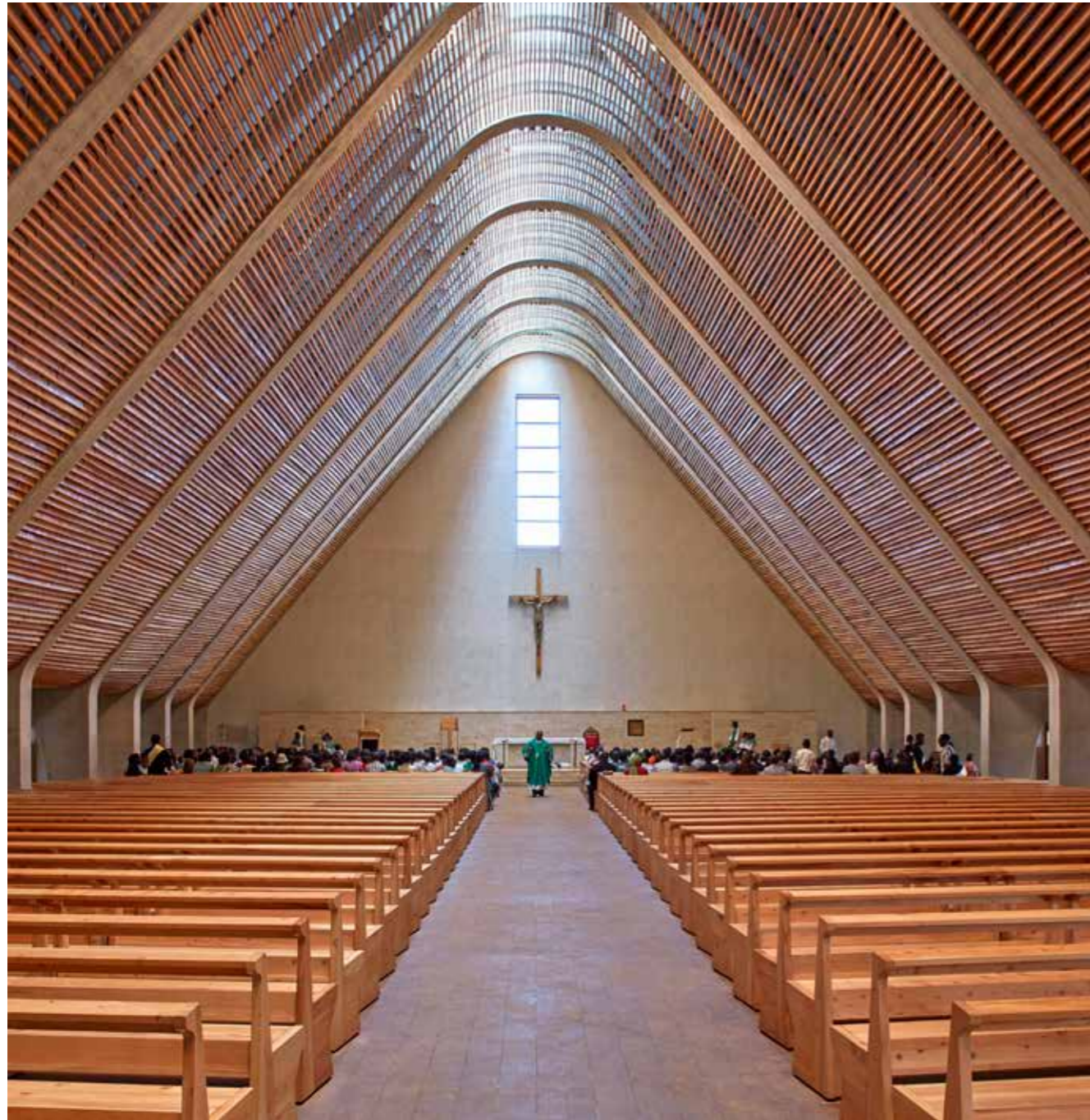
The redevelopment of King's Cross station in the city of London has turned a historic rail terminus into a dynamic transportation hub and a destination in its own right. The concourse lighting needed to be energy efficient, be easy to maintain and meet Network Rail's lighting standards. Our lighting design team proposed an uplighting scheme with daylight-linked fixtures. Natural light, via strategically placed glazed roof panels, illuminates the heritage façades during the day. After dark, passengers can see the striking roof design clearly illuminated beneath the night sky.

Photography © Hufton + Crow

“The new concourse represents a significant achievement in engineering and architecture. It is an exceptional addition to a significant London landmark.”

Ian Fry, Network Rail





**Cathedral of the Sacred Heart  
Kericho, Kenya**

Architect: John McAslan + Partners

Kericho Cathedral is a unique place of worship in Kenya's Great Rift Valley, North West of Nairobi. The design creates a unique and sacred place for a congregation of 1,250 seated celebrants under one giant unifying roof. Natural light is embedded in the design of the building creating a timeless space for worship and contemplation. The ascending interior volume creates a visual hierarchy towards the altar, illuminated by the shaft of light formed by the full length central skylight.

Photography © John McAslan + Partners; Edmund Sumner



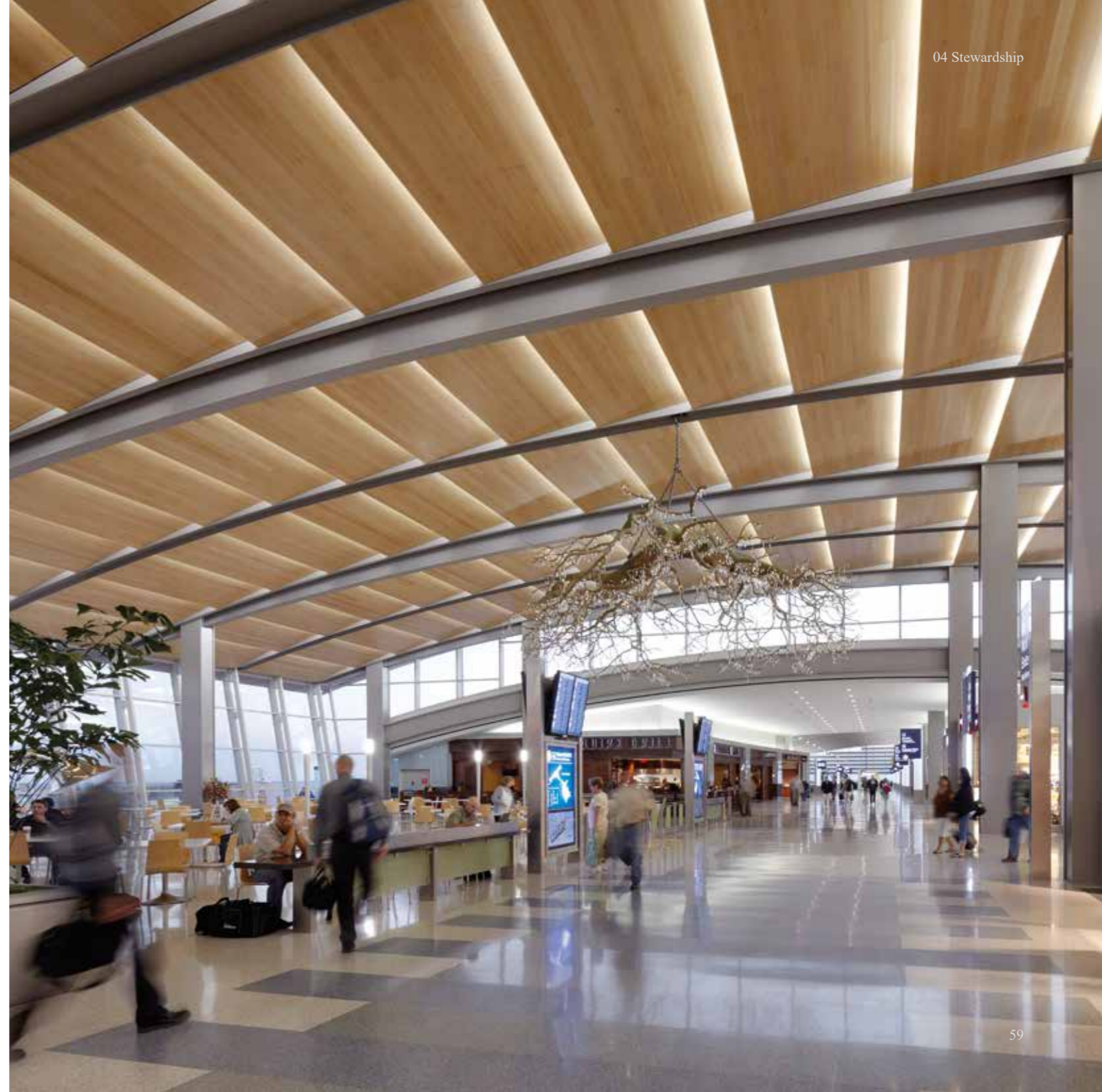


### Sacramento International Airport, Terminal B Sacramento, California, USA

Architect: Fentress Architects

The Terminal Modernization Program at the Sacramento International Airport included the construction of a new international terminal and airside buildings to replace the outdated facility. The new \$1bn scheme uses natural daylight in architectural harmony with the electric lighting to reduce the overall energy consumption while enhancing the visitor experience and passenger journey. The louvred, fully-glazed façade provides thermal protection as well as visual comfort by tempering the direct sunlight coming into the building. The project achieved LEED Silver certification and reducing energy use through lighting was a key driver for this.

Photography © John Swaine, Jake Wayne, Tim Griffith

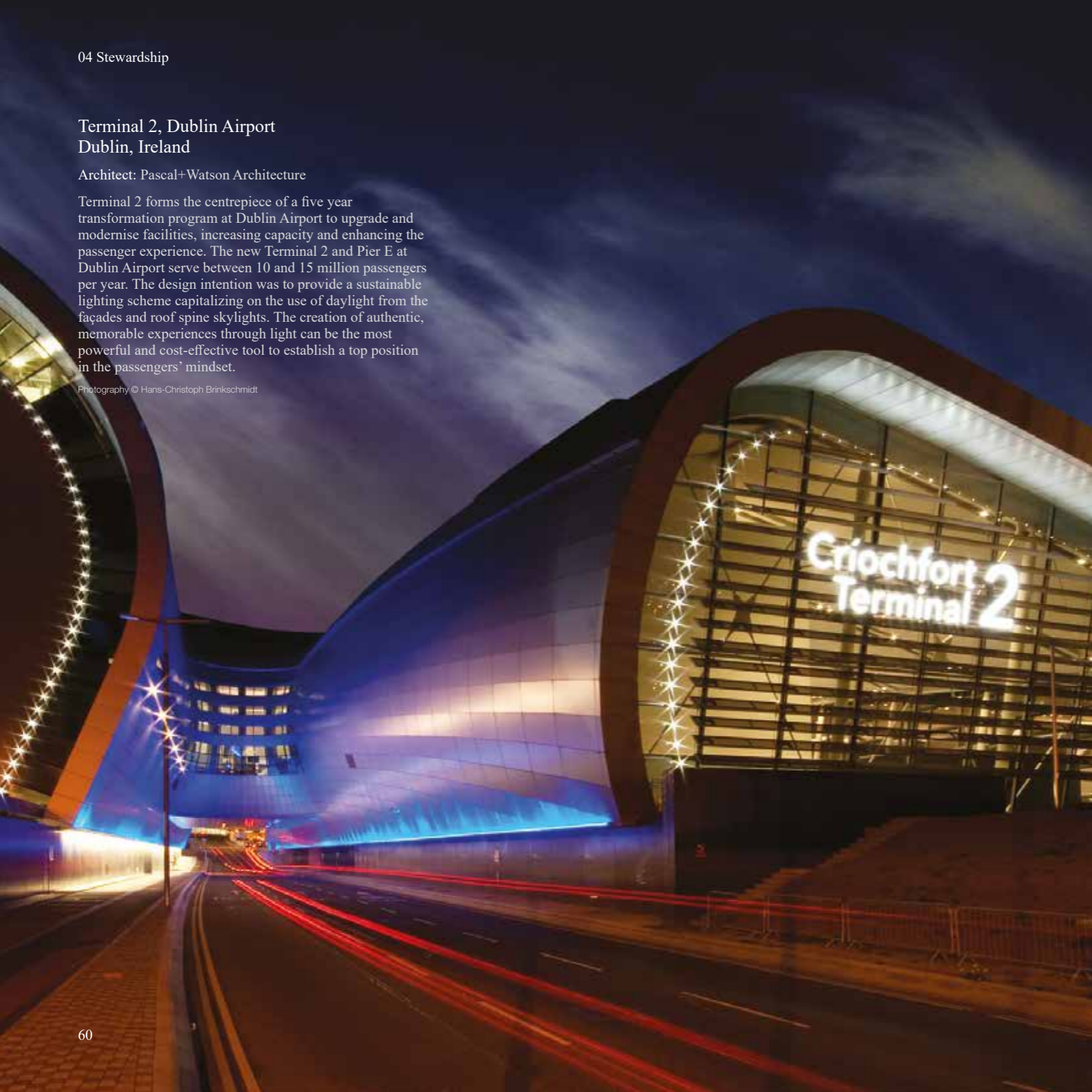


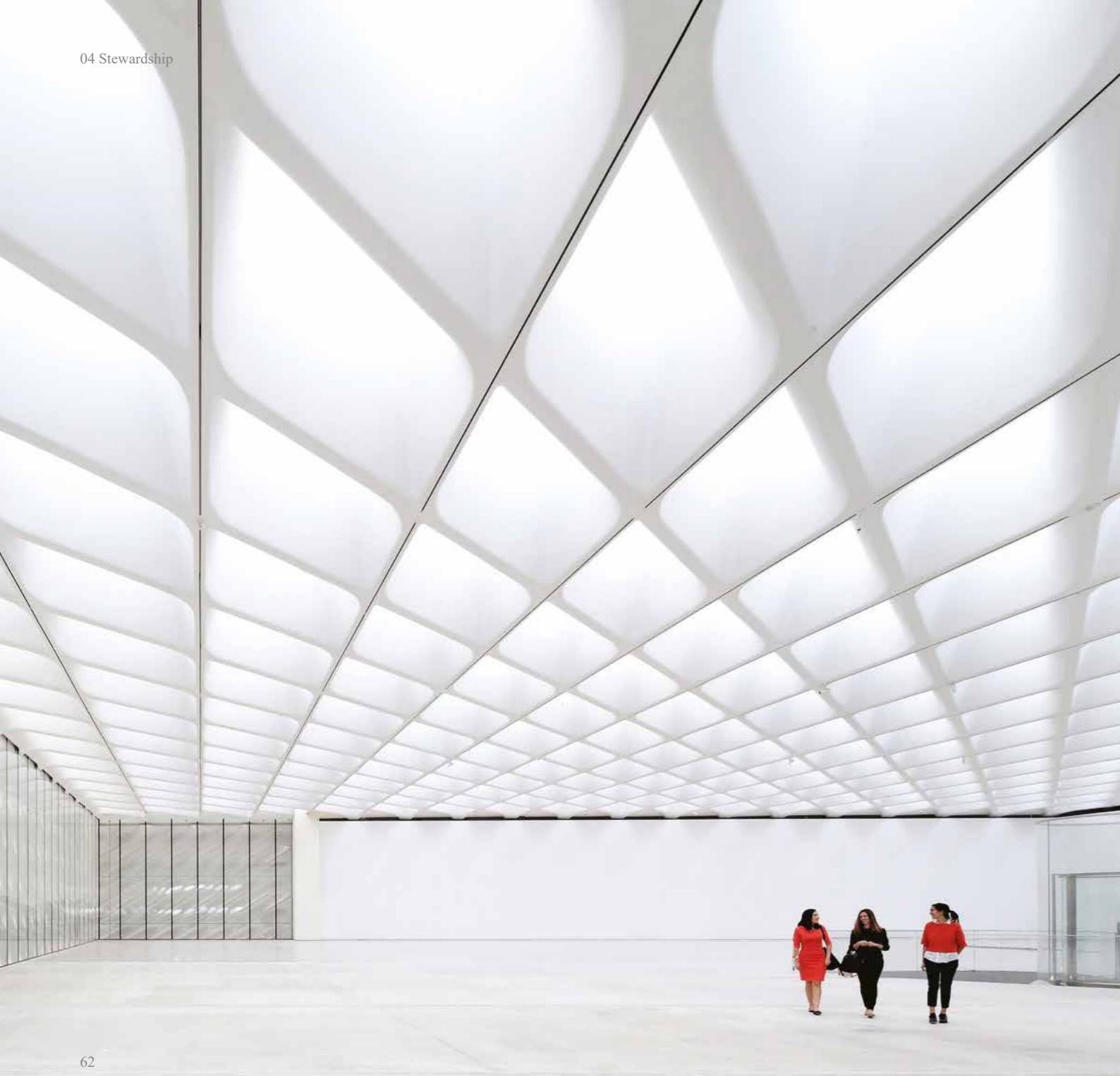
### Terminal 2, Dublin Airport Dublin, Ireland

Architect: Pascal+Watson Architecture

Terminal 2 forms the centrepiece of a five year transformation program at Dublin Airport to upgrade and modernise facilities, increasing capacity and enhancing the passenger experience. The new Terminal 2 and Pier E at Dublin Airport serve between 10 and 15 million passengers per year. The design intention was to provide a sustainable lighting scheme capitalizing on the use of daylight from the façades and roof spine skylights. The creation of authentic, memorable experiences through light can be the most powerful and cost-effective tool to establish a top position in the passengers' mindset.

Photography © Hans-Christoph Brinkschmidt





**The Broad**  
 Los Angeles, California, USA

Architect: Diller Scofidio + Renfro

Arup worked closely with architects Diller Scofidio + Renfro to develop the lighting design for the gallery spaces of The Broad, a 120,000ft<sup>2</sup> contemporary art museum in downtown Los Angeles. One of the highlights of the museum is the open plan third-floor gallery, daylit by over 300 north-facing skylights and a fully-shaded glazed east wall. The skylights and veil structure serve as a light filtration device, bringing indirect, diffuse daylight into the gallery. The skylights include exterior motorised shades that can be used to create zones with reduced daylight levels through their partial deployment. We also assisted in the development of custom LED wallwashers which are used to uniformly illuminate the 23ft gallery walls.

Photography © Hutton+Crow, Arup and Bruce Damonte





# 05 Story

LEF Future Centre, Rijkswaterstaat  
Utrecht, The Netherlands

Photography © Chris Wolzak

In entertainment and movies alike,  
light is a narrative element of the set

In architecture, we like to explore this dimension of light. Retail spaces benefit from a strong narrative, and façades can convey a brand or corporate identity using light and shadow.

Lighting is increasingly intersecting with video and media, converging with a single visual concept, and Arup's lighting studio continues to design some of this field's pioneering projects.

China Resources Times Square  
Shanghai, China

Architect: nendo x Nomura

Photography © Kingkay Architectural Photography





### San Francisco City Hall San Francisco, California, USA

San Francisco City Hall celebrated its centennial in 2015. Ahead of the festivities, Arup retrofitted the historic building's exterior lighting with a dynamically-controlled LED system. The building was previously lit by a labour intensive metal halide system which relied on colour gels that needed to be manually swapped out.

The upgrade reduced energy use by half, significantly cut labour costs, and extended the hours of life for each light fixture. The new system still accentuates the features of the historic building, but also allows more flexible use of colour and white light, delighting visitors and passersby.

Photography © KuDa Photography; Arup





**Sunstar Communication Park  
Osaka, Japan**

Architect: KMDW + Kajima Design

A new headquarter for the Sunstar Group sits within an 18,000m<sup>2</sup> landscape site, open for the public. The 3-story building consists of a showroom, cafe/restaurant and communication hall on the ground floor, and open offices on the upper floors. A large skylight and void space in the heart of the building interconnects each floor and enhances a sense of openness. The office areas adopt suspended or recessed linear lighting systems for varying ceiling heights, providing a consistent experience. After dark, uplighting to louvers of the main façade express the verticality while blending with the surrounding landscape.

Photography © SS Osaka Hiroyuki Tsuda



**Amsterdam Public Library  
Amsterdam, The Netherlands**

Architect: Jo Coenen

For the new public library Arup worked in close collaboration with Jo Coenen to make his vision of a space where visitors experience a unique sense of spaciousness a reality. In order to achieve the desired aesthetic and distribution of light, great effort was taken to integrate lighting into the architectural volumes, which appear as glowing wayfinding elements that provide functional lighting at the same time. With a power consumption of less than 1.1W per square foot, our lighting scheme is highly efficient.

Photography © Michael van Oosten



**Park Square**  
Umhlanga, South Africa

Architect: MAP Architects

The Park Square development in Umhlanga New Town Centre, Kwa-Zulu Natal, is a mixed-use office and retail development. The overall external lighting strategy was to create a rich new public space and a new landmark for the community. The perimeter glow from the retail units was supplemented by lit elements within the piazza, such as uplit trees, providing visual interest in the vertical plane, and integrated bench lighting. Together, this lighting helps to draw people through the piazza, following the main public routes and through the retail space.

Photography © Arup; Peter Oravec



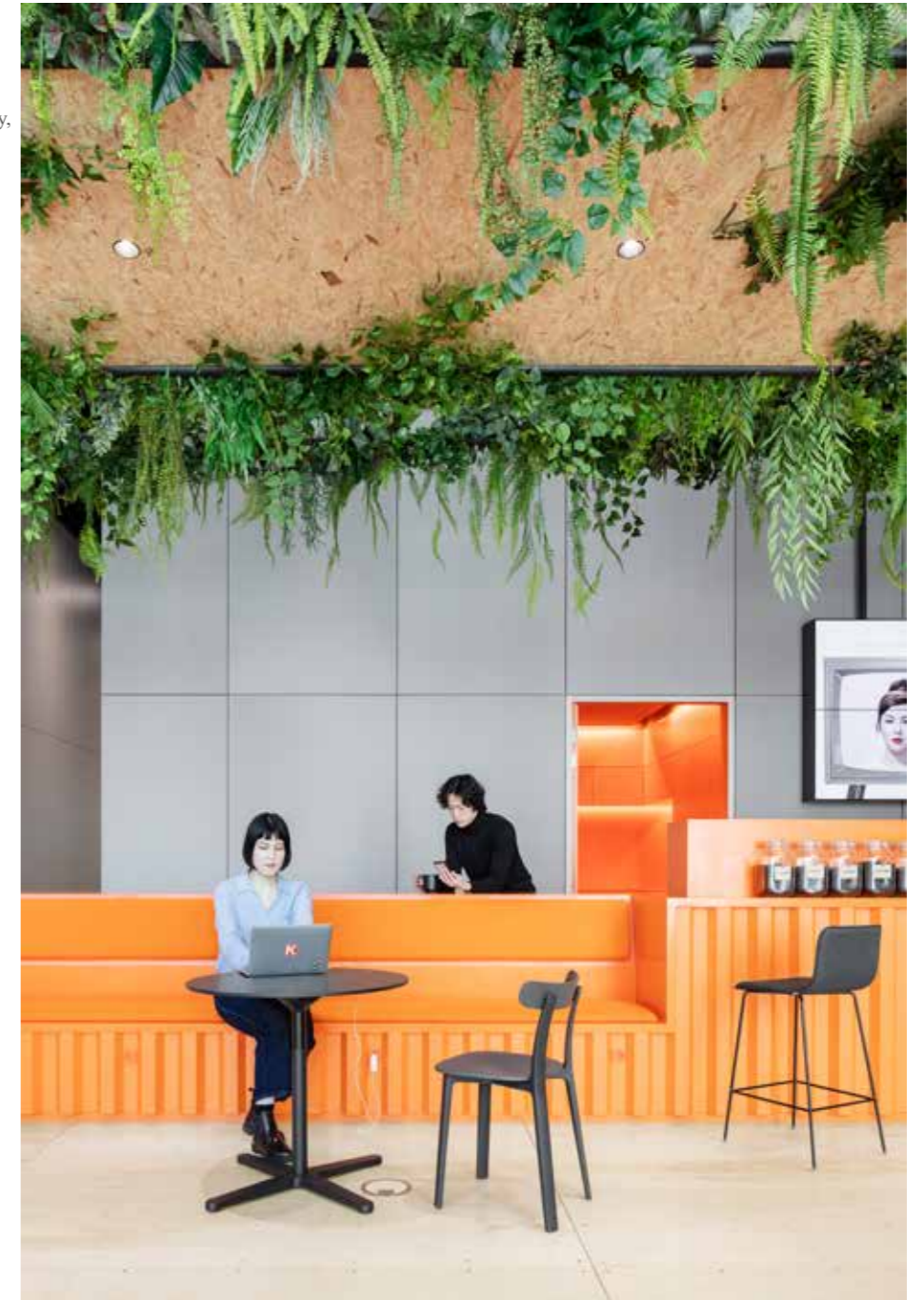


## Amorepacific Headquarters Seoul, South Korea

Architect: David Chipperfield Architects

Characterised by openness and transparency, the building combines a wide variety of room uses, all of which require individual lighting solutions. A complete family of luminaires, as an innovative luminaire system, was developed specifically for this project in order to meet these requirements in a technical, flexible, sustainable and aesthetically pleasing way, in harmony with the architecture. As part of the LEED agenda, breakout spaces were developed with biophilic design principles that are incorporated into the user experience.

Photography © Arup; Schnepf Renou



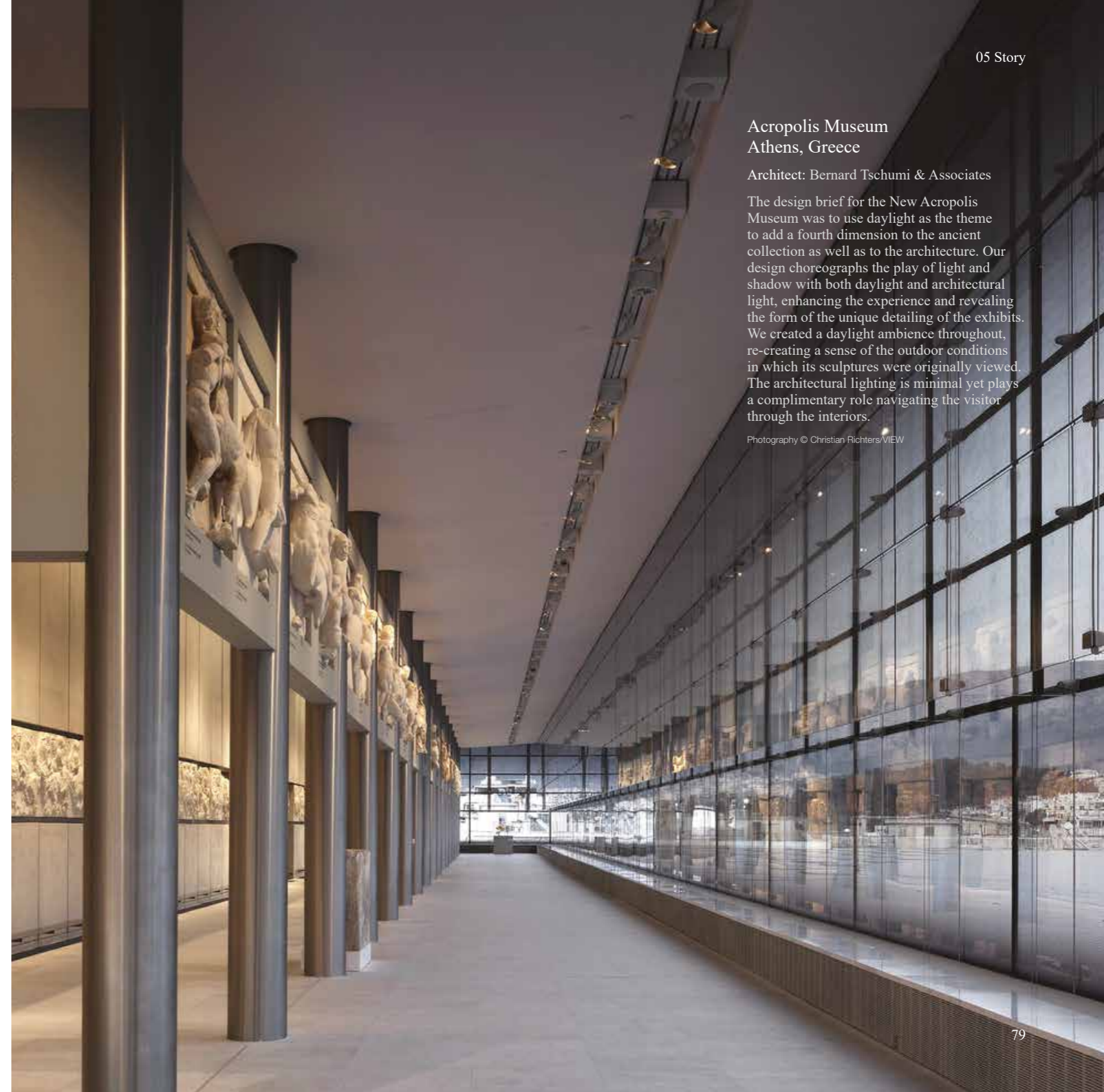


## Acropolis Museum Athens, Greece

Architect: Bernard Tschumi & Associates

The design brief for the New Acropolis Museum was to use daylight as the theme to add a fourth dimension to the ancient collection as well as to the architecture. Our design choreographs the play of light and shadow with both daylight and architectural light, enhancing the experience and revealing the form of the unique detailing of the exhibits. We created a daylight ambience throughout, re-creating a sense of the outdoor conditions in which its sculptures were originally viewed. The architectural lighting is minimal yet plays a complimentary role navigating the visitor through the interiors.

Photography © Christian Richters/VIEW







Stavros Niarchos Foundation Cultural Centre  
Athens, Greece

Architect: Renzo Piano Building Workshop

The Stavros Niarchos Foundation Cultural Centre (SNFCC) is a multi-functional cultural and leisure destination located on Athens' waterfront. Arup designed lighting throughout, incorporating requirements for daylighting, architectural and technical lighting, everyday lighting, and event lighting. Light expresses the form and materiality of this multi-faceted building, revealing the character and individuality of its components. The theatre house lighting is inspired by the natural sky colour transition from day to night and subtly but beautifully changes throughout a play to mark the beginning, intermission and end of a show.

Photography © Yiorgis Yerolymbos

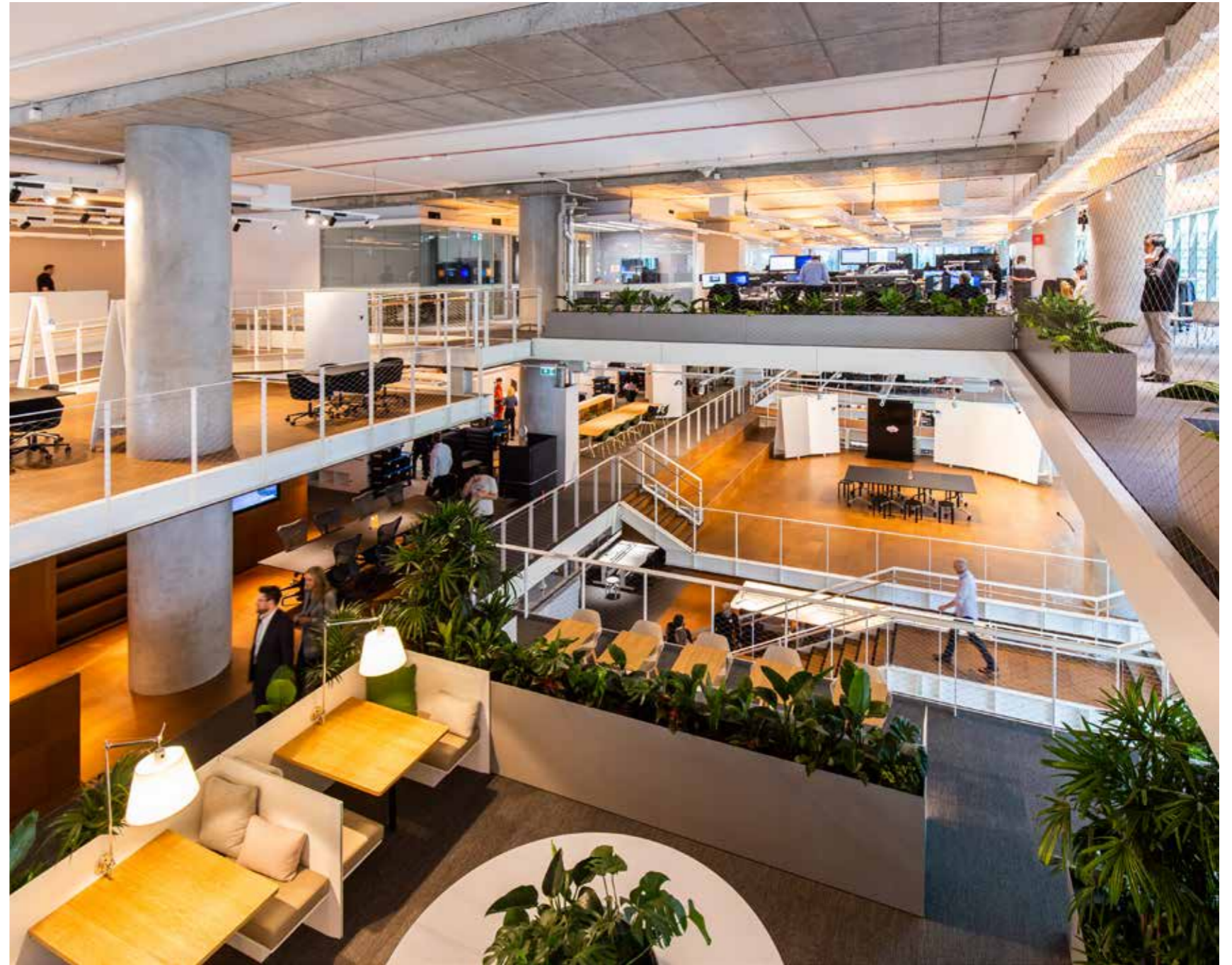




### Australia Arup Offices

In a long-term collaboration between design and engineering, we created a workplace that invites people back, resonates with them, inspires them to reflect on their knowledge, and through increased connectivity, promotes the open sharing of ideas. The resulting workplace has created a new paradigm in how teams interact and develop creative approaches to work.

Photography © Arup

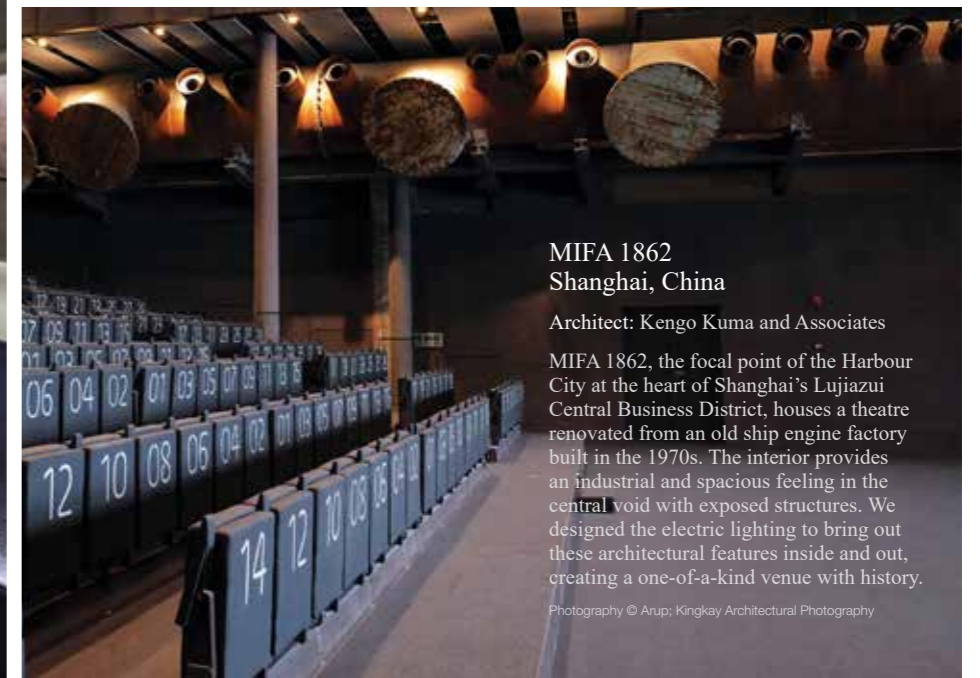
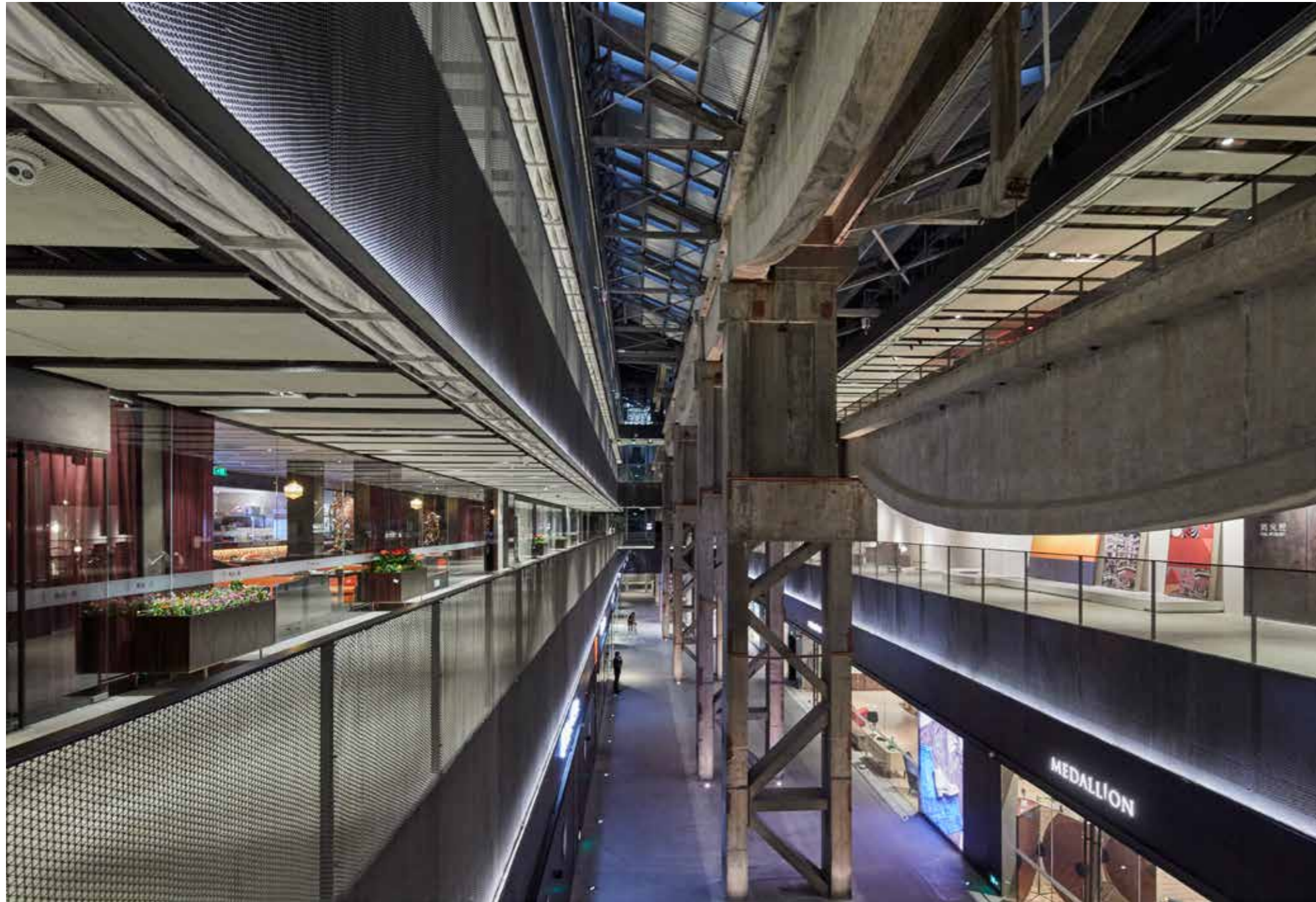




### Qasr Al Hosn Abu Dhabi, UAE

The oldest building in Abu Dhabi, Qasr Al Hosn mirrors the 200 years of growth and evolution of the city. By 2005, the structure needed extensive conservation and restoration to fulfill its new role as a national monument and cultural centre. The starting point was to make Qasr Al Hosn glow again, while avoiding having any visible lighting equipment. In the cloisters and rooms of the Outer Palace, warm LED lighting is carefully integrated within existing details to preserve, respect and celebrate the heritage of the spaces. The added light highlights the beauty of the architecture and allows the rhythms of the building to speak.

Photography © Department of Culture and Tourism - Abu Dhabi



**MIFA 1862**  
Shanghai, China

Architect: Kengo Kuma and Associates

MIFA 1862, the focal point of the Harbour City at the heart of Shanghai's Lujiazui Central Business District, houses a theatre renovated from an old ship engine factory built in the 1970s. The interior provides an industrial and spacious feeling in the central void with exposed structures. We designed the electric lighting to bring out these architectural features inside and out, creating a one-of-a-kind venue with history.

Photography © Arup; Kingkay Architectural Photography

# 06 Craft

Sound of Light installation for Luminale festival

Photography © Arup

Models, samples, and tabletop setups are  
all part of our design process

Arup's lighting studio uses the craft of hands-on mock ups and installations to make light not only understandable, but also tangible.

Light, as the metaphysical space, integrates with the physical space as it reflects and refracts. We want to understand this aspect of the lighting before we draw construction documents, and keep the clients and the architects that we work with involved throughout the process.

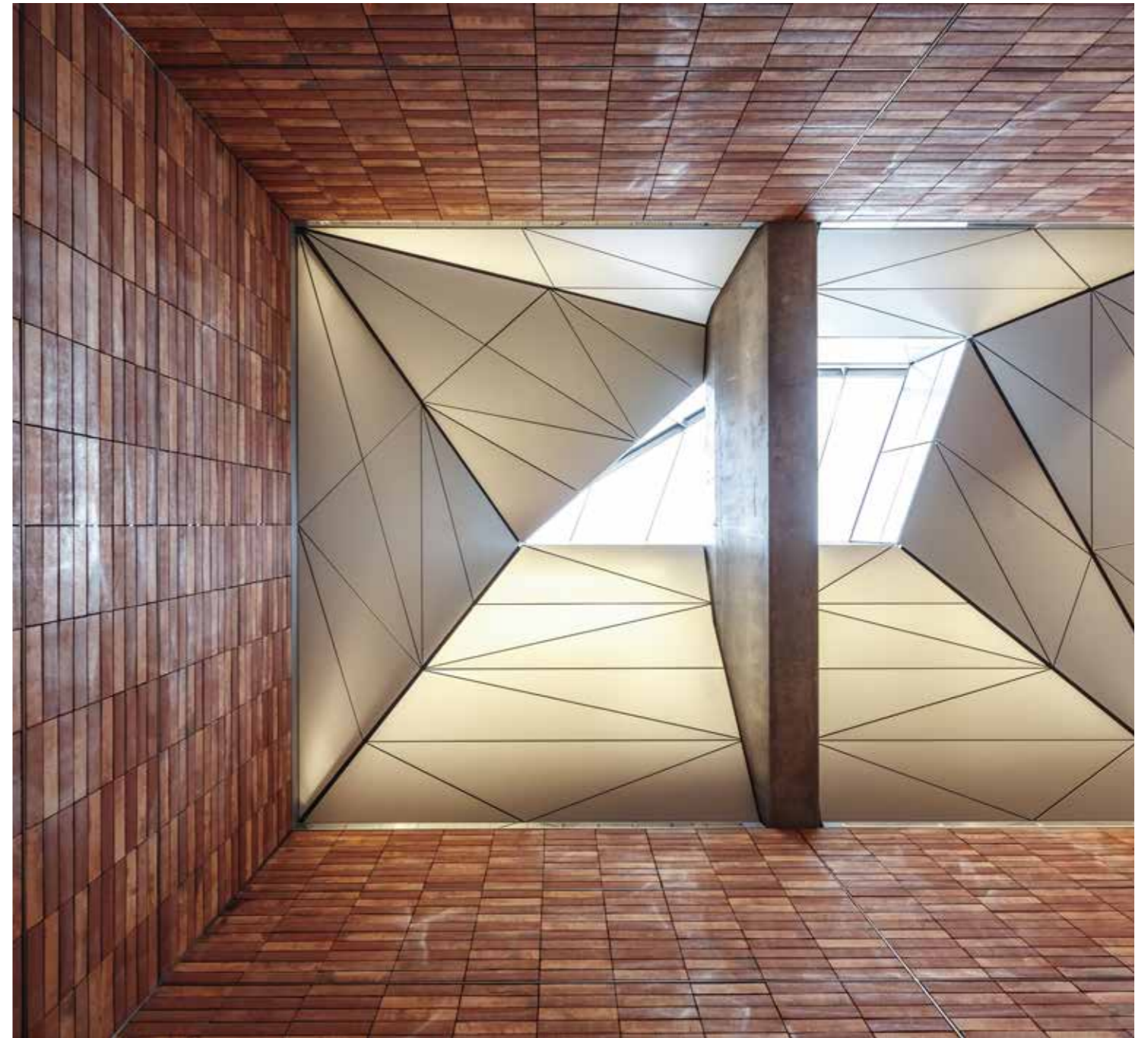
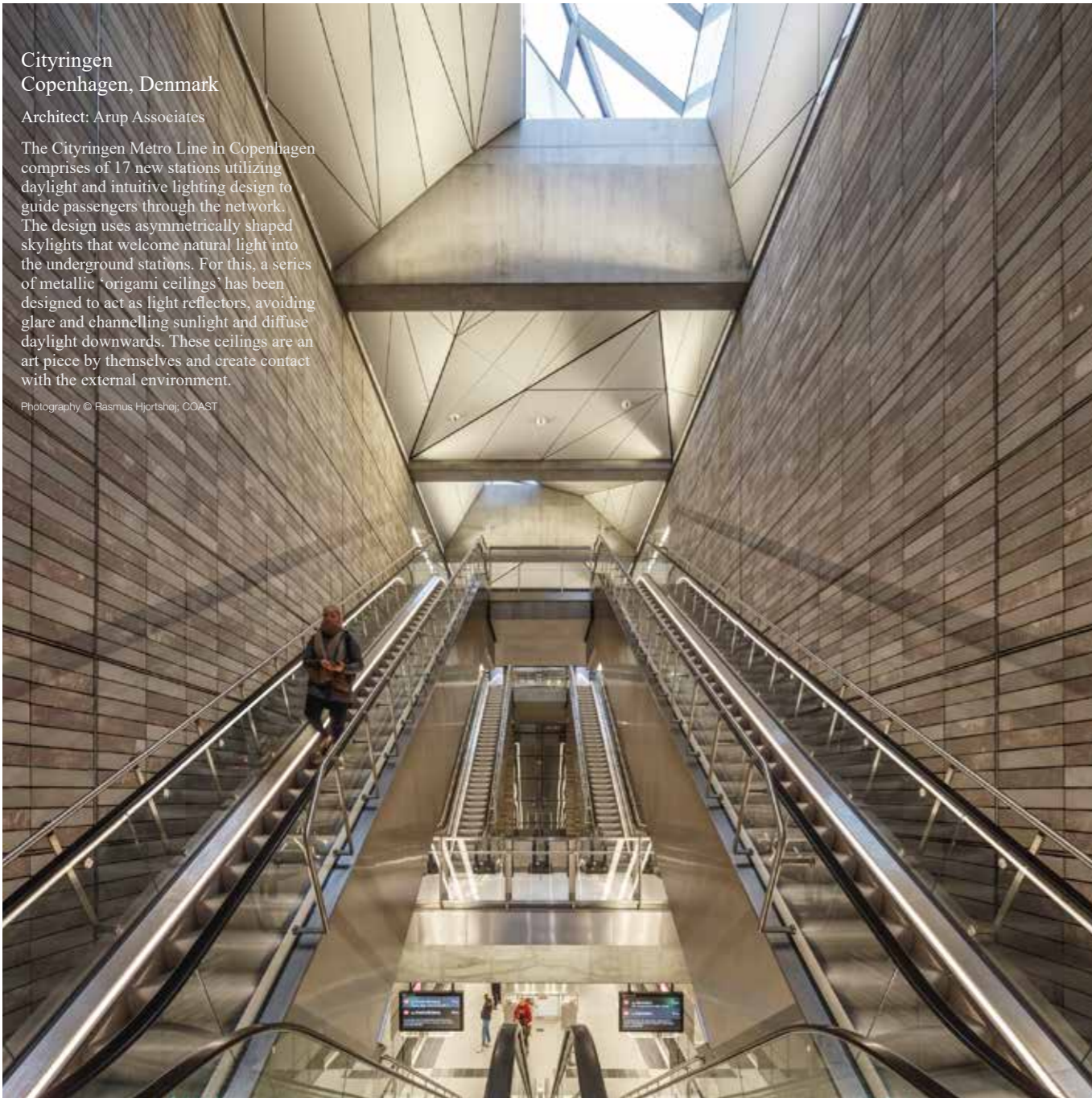
Cityringen  
Copenhagen, Denmark

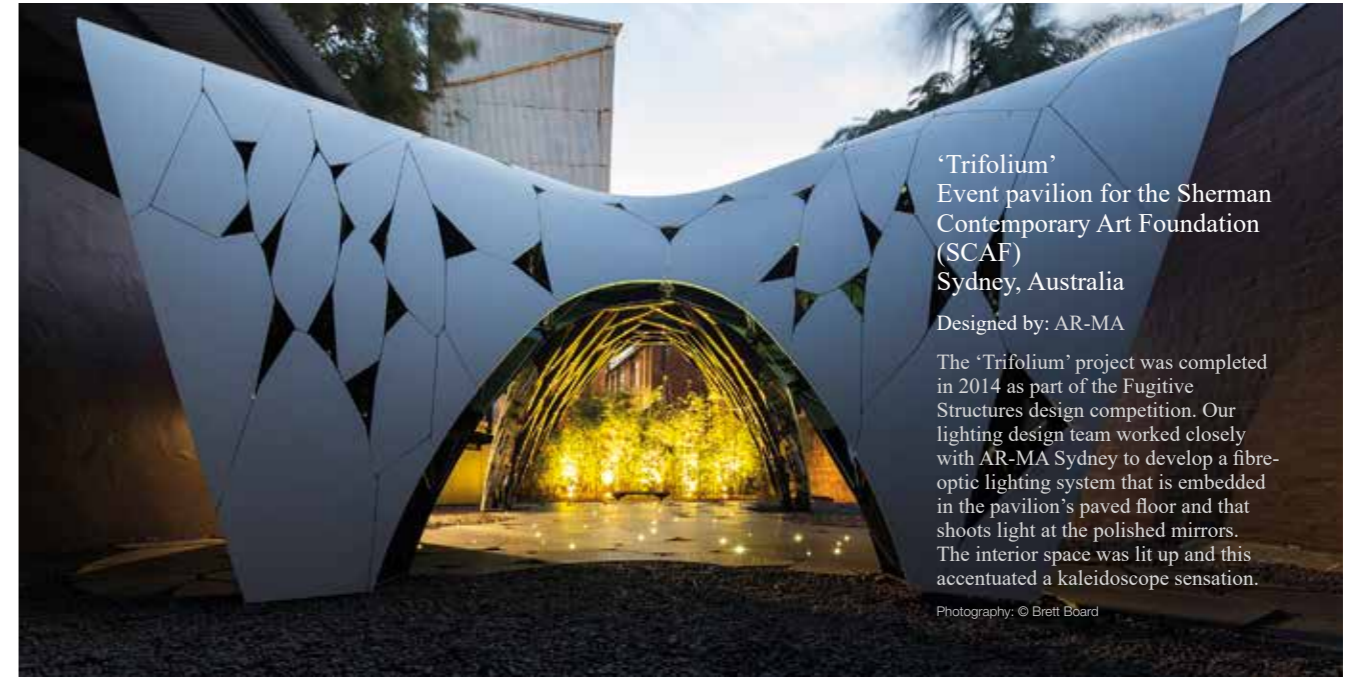
Architect: Arup Associates

Testing materials for use in  
lighting 17 new metro stations.

Photography © Arup







'Trifolium'  
Event pavilion for the Sherman  
Contemporary Art Foundation  
(SCAF)  
Sydney, Australia  
Designed by: AR-MA

The 'Trifolium' project was completed in 2014 as part of the Fugitive Structures design competition. Our lighting design team worked closely with AR-MA Sydney to develop a fibre-optic lighting system that is embedded in the pavilion's paved floor and that shoots light at the polished mirrors. The interior space was lit up and this accentuated a kaleidoscope sensation.

Photography: © Brett Board



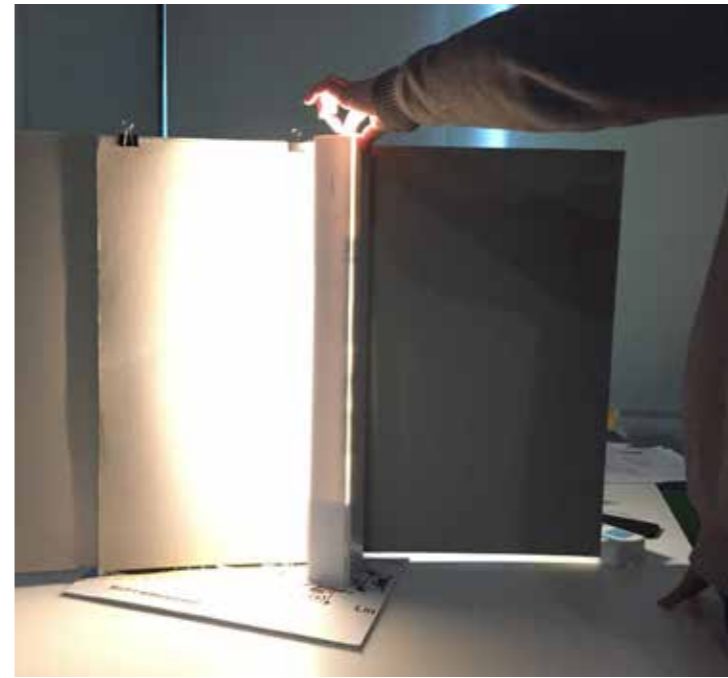
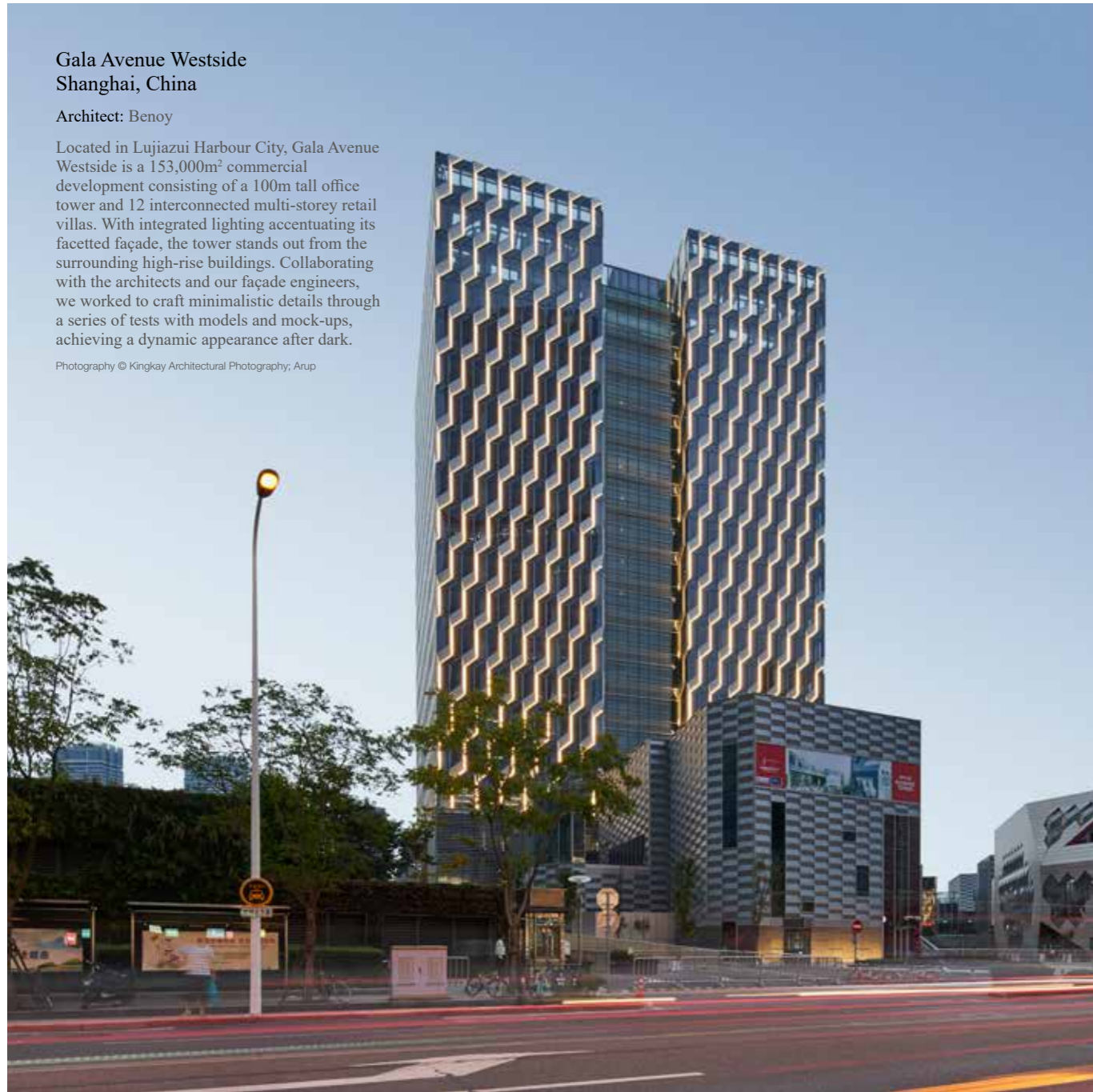


### Gala Avenue Westside Shanghai, China

Architect: Benoy

Located in Lujiazui Harbour City, Gala Avenue Westside is a 153,000m<sup>2</sup> commercial development consisting of a 100m tall office tower and 12 interconnected multi-storey retail villas. With integrated lighting accentuating its faceted façade, the tower stands out from the surrounding high-rise buildings. Collaborating with the architects and our façade engineers, we worked to craft minimalistic details through a series of tests with models and mock-ups, achieving a dynamic appearance after dark.

Photography © Kingkay Architectural Photography; Arup



### Bentley Hero Light for Bentley worldwide

Brand consultant: FutureBrand

The Bentley Hero Light project looked to transfer the rich heritage, prestige and brand identity from the luxury automobiles into the purchasing experience. As the focal point of the new showroom, the 6m diameter Barrisol pendant is suspended as a centrepiece directly above the car below. This uniformly lights the paint finish of the vehicle below with high quality LED light sources and allows the direct reflection of the paintwork to reveal the form and character lines of the car. Various lighting control options allow scene setting and adjustability, important for tuning the light in Bentley dealerships around the globe.

Photography © Arup



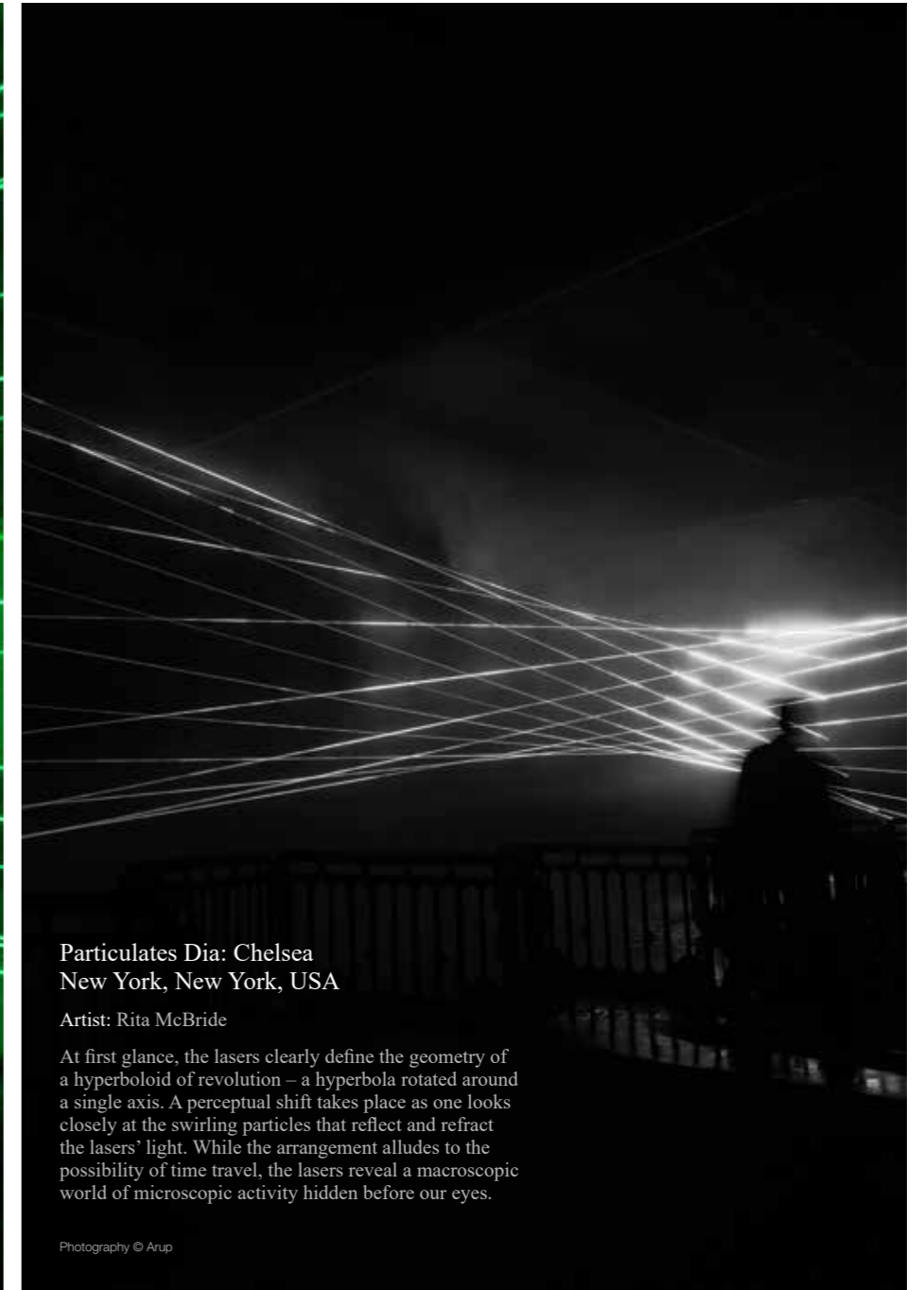


### Melbourne Knowledge Week Melbourne, Australia

Melbourne Knowledge Week (MKW) is an annual festival that brings Melburnians together to explore and discuss, to share ideas, to challenge assumptions, and to spark new ways of thinking. Across seven days, the broad program of events, workshops and performances celebrates the city's rich heritage and potential for innovation. The Arup lighting team prototyped an installation to simulate community controlled smart lighting scenarios for night-time streetscapes. An evening light walk was organised with the community to discover how lighting affects their perceptions of safety at night. Feedback from the engagement was used to help customise the installation.

Photography © Arup





**Particulates Dia: Chelsea  
New York, New York, USA**

Artist: Rita McBride

At first glance, the lasers clearly define the geometry of a hyperboloid of revolution – a hyperbola rotated around a single axis. A perceptual shift takes place as one looks closely at the swirling particles that reflect and refract the lasers' light. While the arrangement alludes to the possibility of time travel, the lasers reveal a macroscopic world of microscopic activity hidden before our eyes.

Photography © Arup



**KOMA Restaurant**  
 Republic of Singapore

Architect: Rockwell Group

Located in The Shoppes at Marina Bay Sands, KOMA restaurant is a new concept from TAO group, a high-end Japanese restaurant and sushi bar offering a modern interpretation of Japanese cuisine. The interior space was designed to incorporate unique detailing and concealing architectural lighting. Key highlights included the entrance lined with orange arches, inspired by Fushimi Inari Shrine in Kyoto, a Japanese foot bridge and a 2.5m tall bell which was complemented by the high ceiling.

Photography © TAO Group

# 07 Science

Alfred Hospital ICU  
Melbourne, Australia

Photography © Rhiannon Slatter

Light can behave as both a wave and a particle; the full spectrum of light, as it reacts with the environment around us, interacts with our eyes to shape our world.

When designing museums, workplaces or public spaces, a deep understanding of the scientific design of light and lighting is critical to the success of your project.

Arup's lighting studio is proud to offer world class design of natural light, including advanced simulation and rendering tools, physical mock-ups in our studios, incorporation of statistical weather data in our designs and thorough knowledge of passive conservation of artefacts on display in a museum. We also believe that sustainability and energy savings are among the most important themes in the near future and have fully integrated these into our approach to every project.

Whittle School and Studios  
Shenzhen, China

Architect: Renzo Piano Buildings Workshop

Photography © Zhangchao



Sainsbury Laboratory  
Cambridge, UK

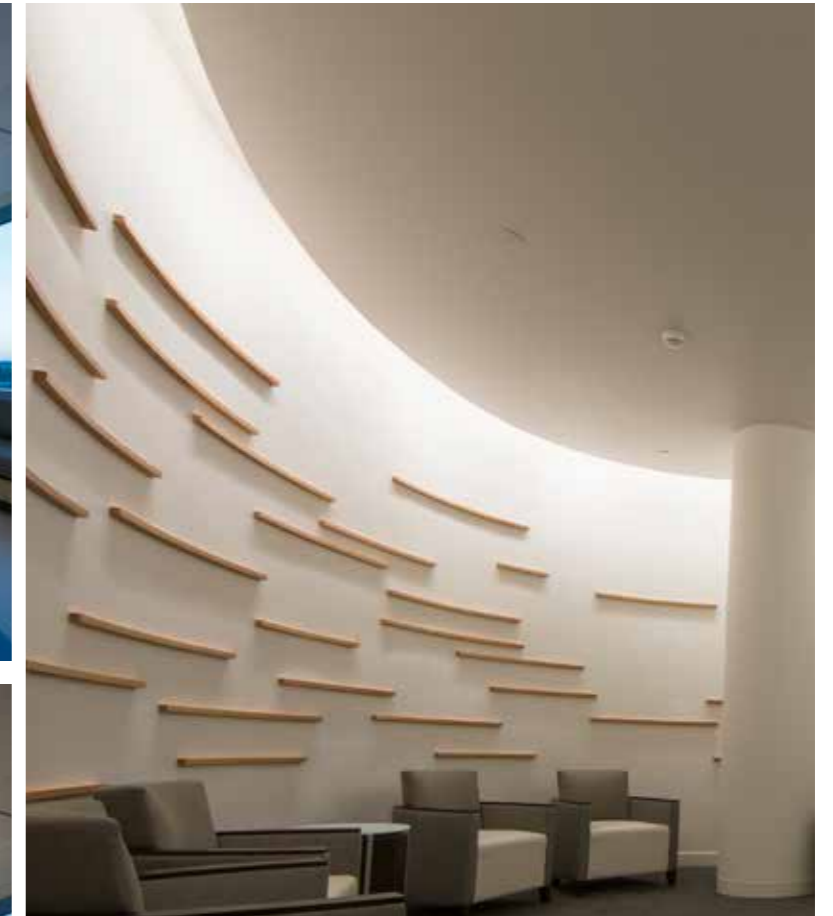
Architect: Stanton Williams Architects

To achieve a high quality and unique working environment that would set the project apart from traditional laboratory buildings, generous but controlled daylight is provided in the working spaces. Carefully integrated electric lighting supplements daylight to create an attractive and stimulating working environment for scientists and support staff.

Photography © Hutton + Crow

“The Sainsbury Laboratory, Cambridge is a unique laboratory, thanks to the extent and quality of natural light that fills the working spaces. The lighting team at Arup has also skillfully matched the daylight conditions in their artificial lighting, therefore maintaining continuity of the lit environment through all conditions.”

Stephen Andrews, Facilities Manager, The Sainsbury Laboratory



Kaiser Permanente San Diego Central Hospital  
San Diego, California, USA

Architect: CO Architects

When complete, the new Kaiser Permanente in central San Diego will be one of the world's most sustainable hospitals. It will also be the first hospital in the world to rely exclusively on LED lighting. In designing the lighting scheme, Arup emphasised the inclusion of lighting features that promote the wellness and comfort of patients and families. Each patient room features variable warm or cool lighting that echoes and reinforces the body's circadian rhythms; meditation rooms are softly illuminated to provide a contemplative space for patients and visitors; and work space lighting schemes address the practical needs of hospital staff while still providing a pleasant atmosphere.

Photography © Arup

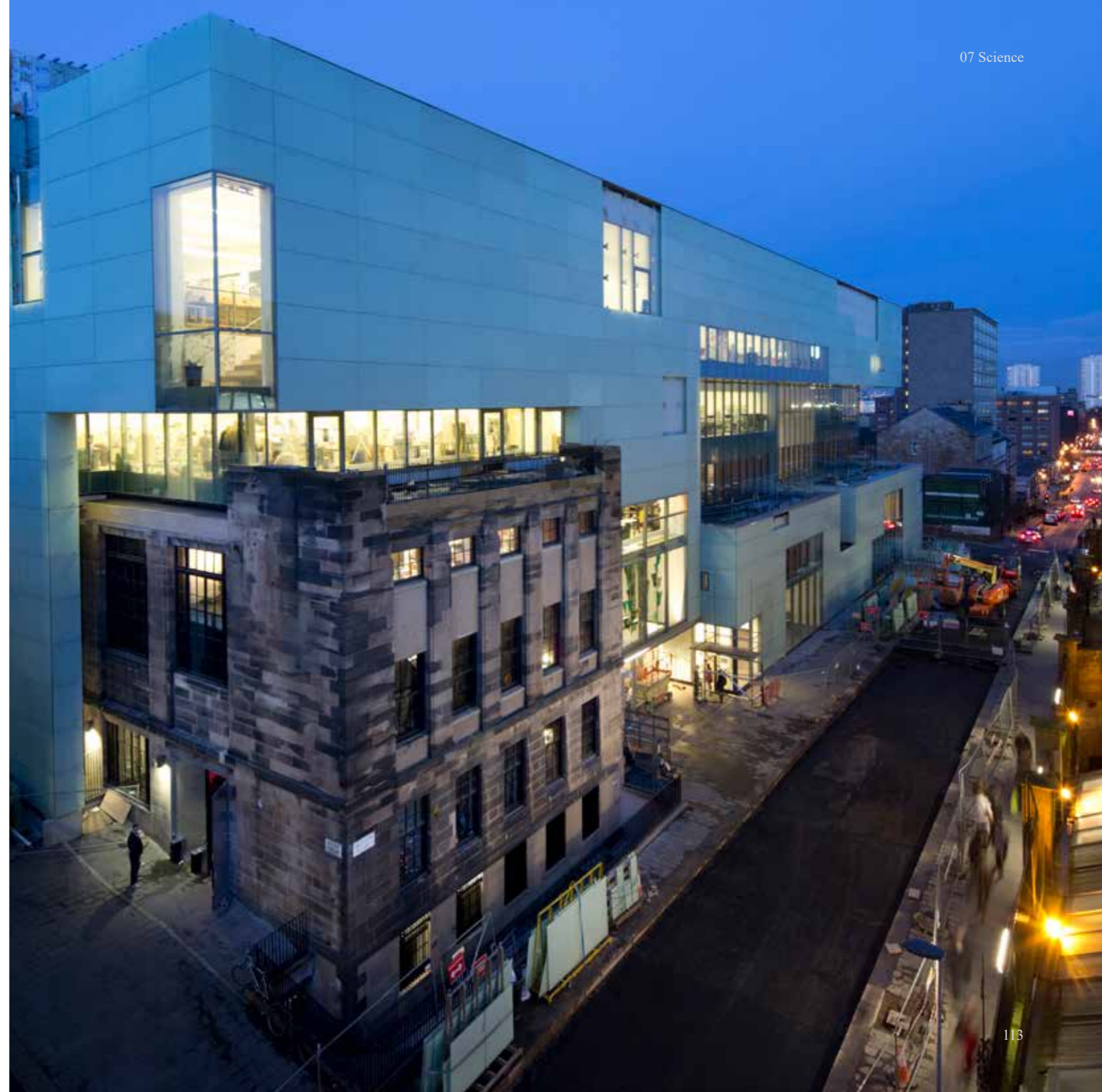
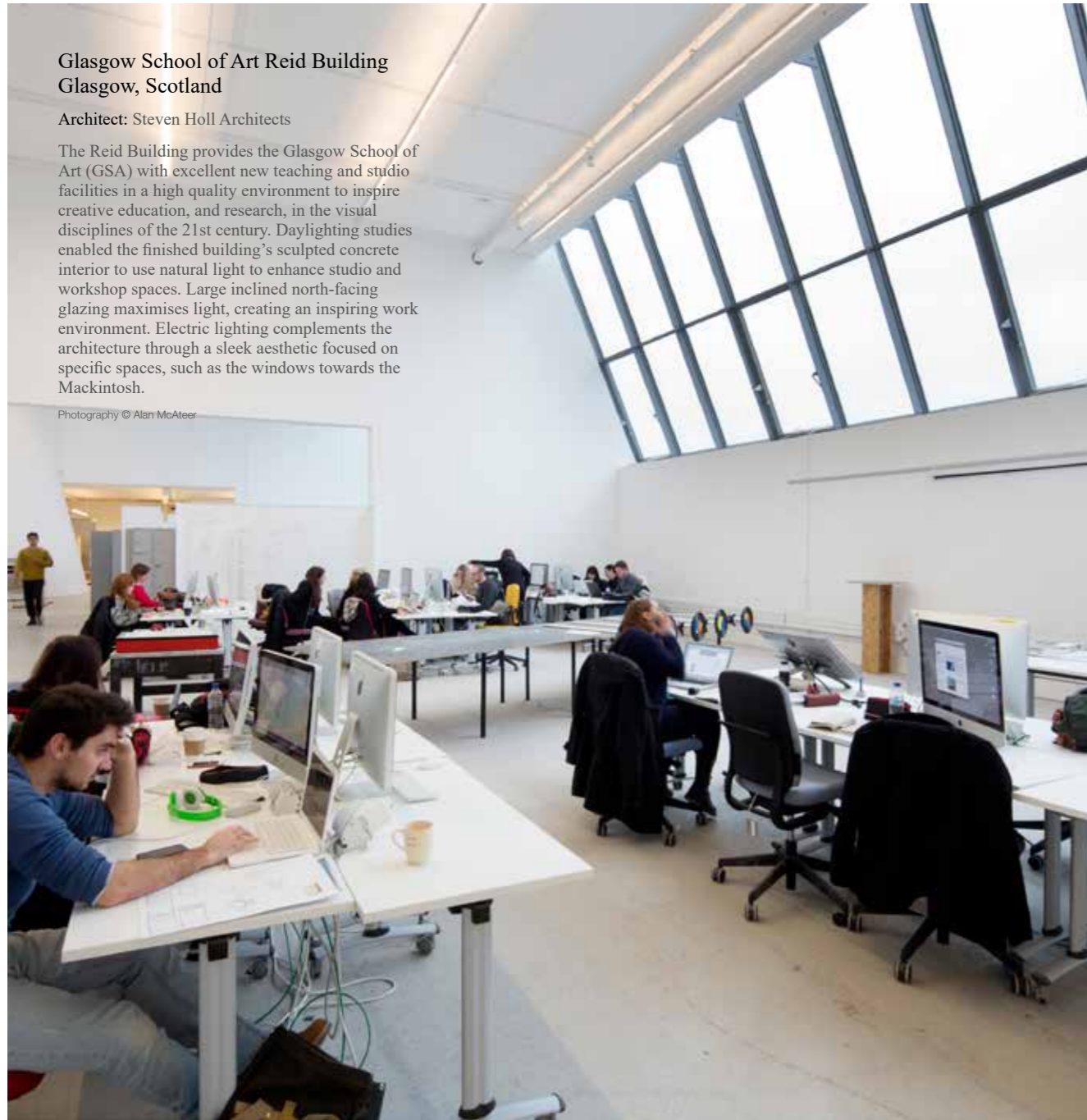


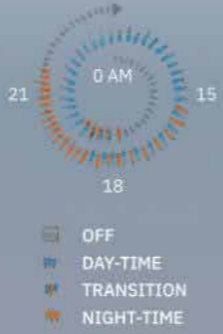
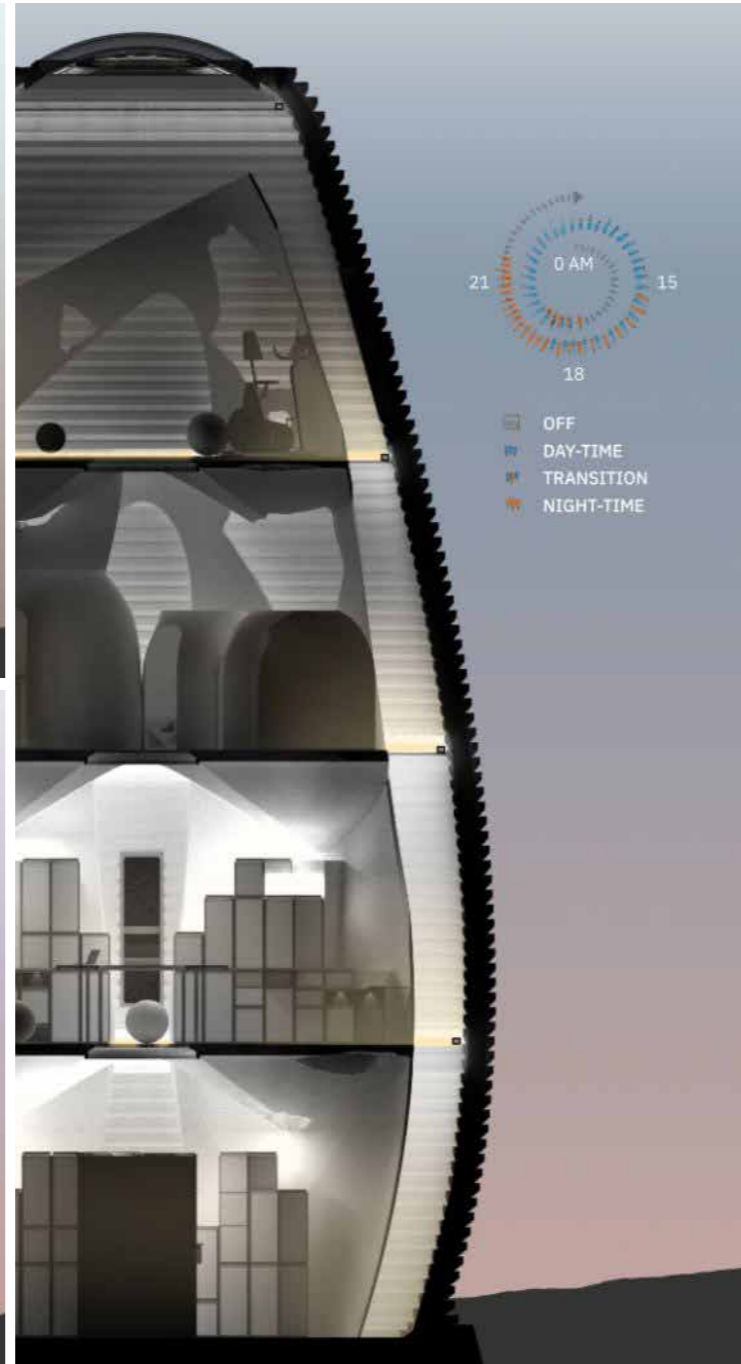
## Glasgow School of Art Reid Building Glasgow, Scotland

Architect: Steven Holl Architects

The Reid Building provides the Glasgow School of Art (GSA) with excellent new teaching and studio facilities in a high quality environment to inspire creative education, and research, in the visual disciplines of the 21st century. Daylighting studies enabled the finished building's sculpted concrete interior to use natural light to enhance studio and workshop spaces. Large inclined north-facing glazing maximises light, creating an inspiring work environment. Electric lighting complements the architecture through a sleek aesthetic focused on specific spaces, such as the windows towards the Mackintosh.

Photography © Alan McAteer





## MARSHA

Architect: AI.SpaceFactory

What will it take to allow human life to not just be sustained, but to live and thrive on Mars? This was a question that NASA asked in their 3D printed habitat challenge. In an alien environment of a planet about 54 million kilometres away, construction, design and material need to be rethought entirely. We at Arup understood, that to enable life to truly thrive on Mars, the buildings would also need to function as machines that keep humans alive and well so we took a human-centric design approach that considered the extreme environmental conditions on Mars. The electrical lighting systems installed in the outer shell, run on an astronomical timeclock, they provide light with a peak in a part of the visible light spectrum that scientists currently believe to have a significant effect on the entrainment of human circadian rhythms, helping the crew to remain active and focused during the day, towards the evening the lighting system shifts to a warmer colour temperature with less intensity cuing the crew to prepare for night time activities and sleep. Our proposed habitat - MARSHA, granted first place in the final of the competition.

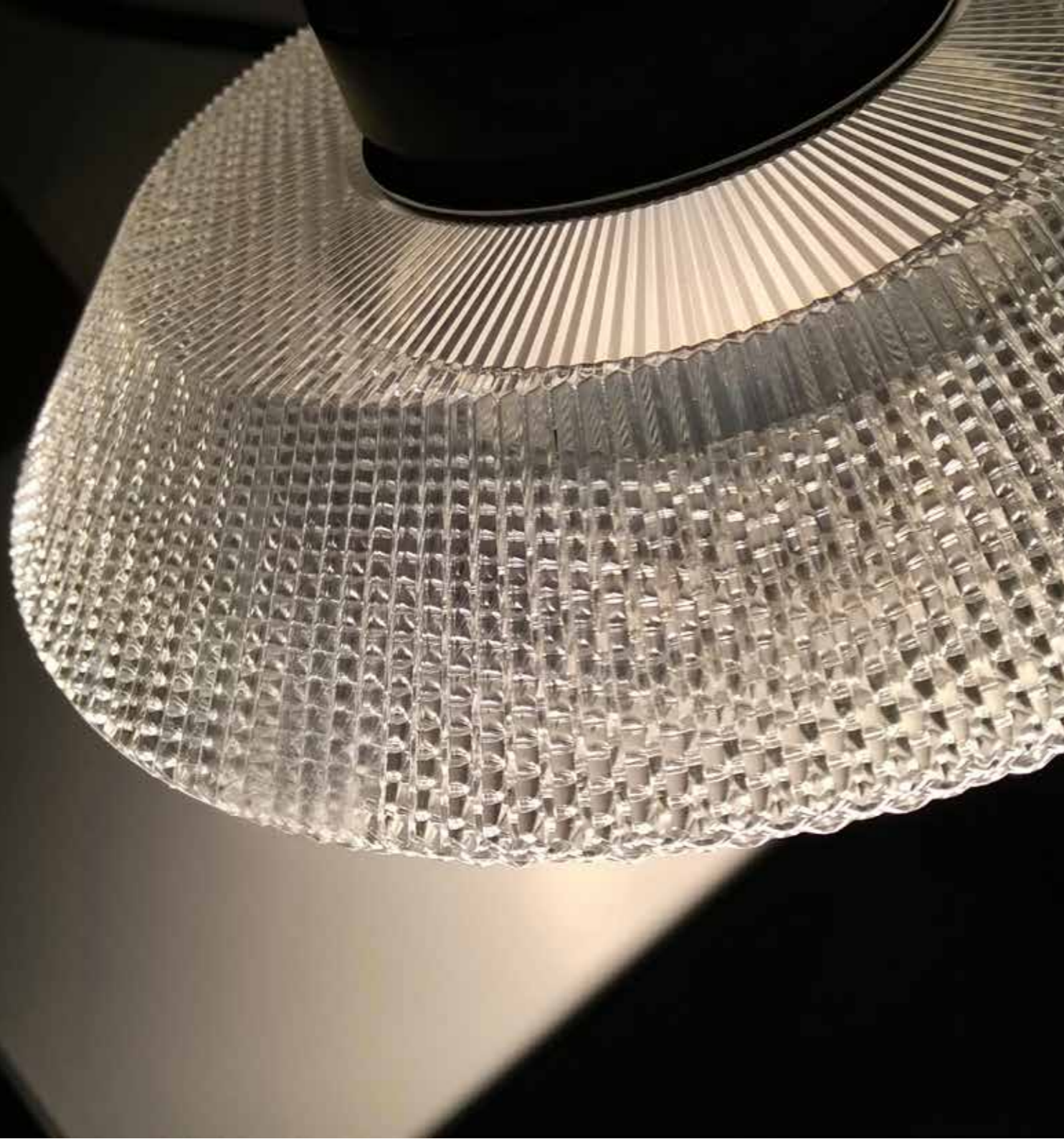
Photography © Arup, ai.spacefactory / Piomp



### Amorepacific Luminaire Design Seoul, South Korea

Amorepacific operates 28 different brands under one roof, so a high level of flexibility for the current and future use of the space was required. The need for various light atmospheres in the building mirrored its multi-use nature. We developed a variety of lighting solutions for the building, removing the need to bring together several luminaire types and manufacturers. The bespoke lens product is adaptable for all occasions and allows full replacement of parts, making easy transitions for the changing needs of the building.

Photography © Arup



“We created an innovative optical tool kit that allows the design of a series of different light distributions using the same luminaire body shape in the entire building. The idea of a luminaire product line as a modular system was born.”

Alexander Rotsch, Arup Europe Lighting Lead



## Singapore Sports Hub Republic of Singapore

Architect: DP Architects Pte Ltd

Singapore Sports Hub is the first stadium in the world to be purpose built for football, rugby, cricket and athletics, as well as for concerts and festivals. A moveable tier of seats can be pushed forward when the track is not in use, so there's no compromise of the spectator experience whatever the event. The ETFE pillow moving roof appears translucent during the day; at night, it is one of the largest LED screens in the world and an unmistakable feature on the Singapore skyline.

Photography © Arup



## WSU Veterinary Medical Building Pullman, Washington, USA

Architect: SRG Partnership Inc.

Arup worked within the client's strict budget to deliver a state-of-the-art, sustainably-designed research building that provides a collaborative atmosphere where faculty, researchers, and graduate students can work together. The lighting and architecture, integrally conceptualised, create an inspiring and welcoming environment for the researchers. Laboratories have expansive views out to the landscape, allowing abundant daylight to inspire research, while reducing energy consumption. Wood finishes within the interiors work in harmony with the lighting to create a unique research setting connecting the interiors with the landscape beyond.

Photography © Lara Swimmer

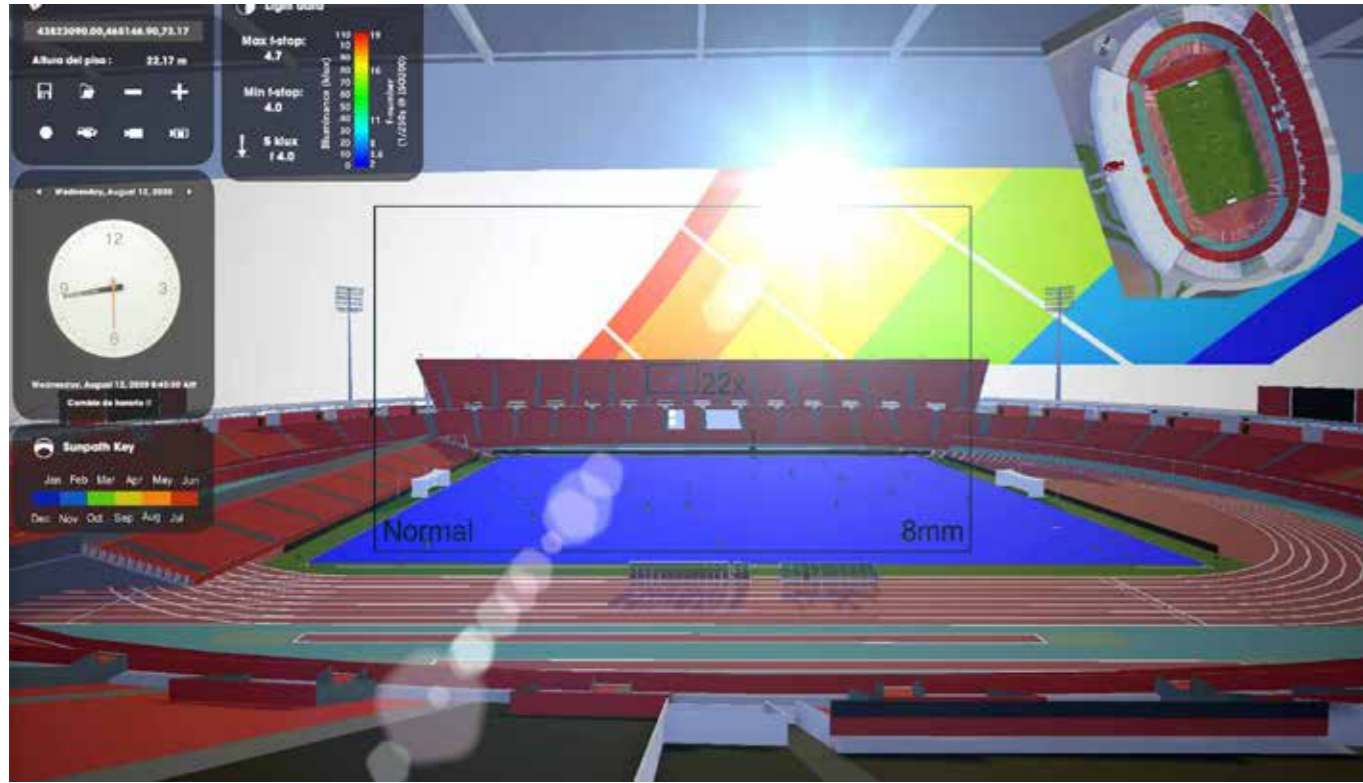


# 08 Digital

Lighting has gone digital, not only with the source technology, but also with our customised solution services. Our digital services range from developing custom analytics, to custom design service solutions.

Digital tools sharpen our lighting design practices, enabling us to offer new levels of insight to clients. They enable us to map lighting effects at the city level, using sensors and machine learning.

# How do you design a football stadium for an optimal television broadcast and fan experience?

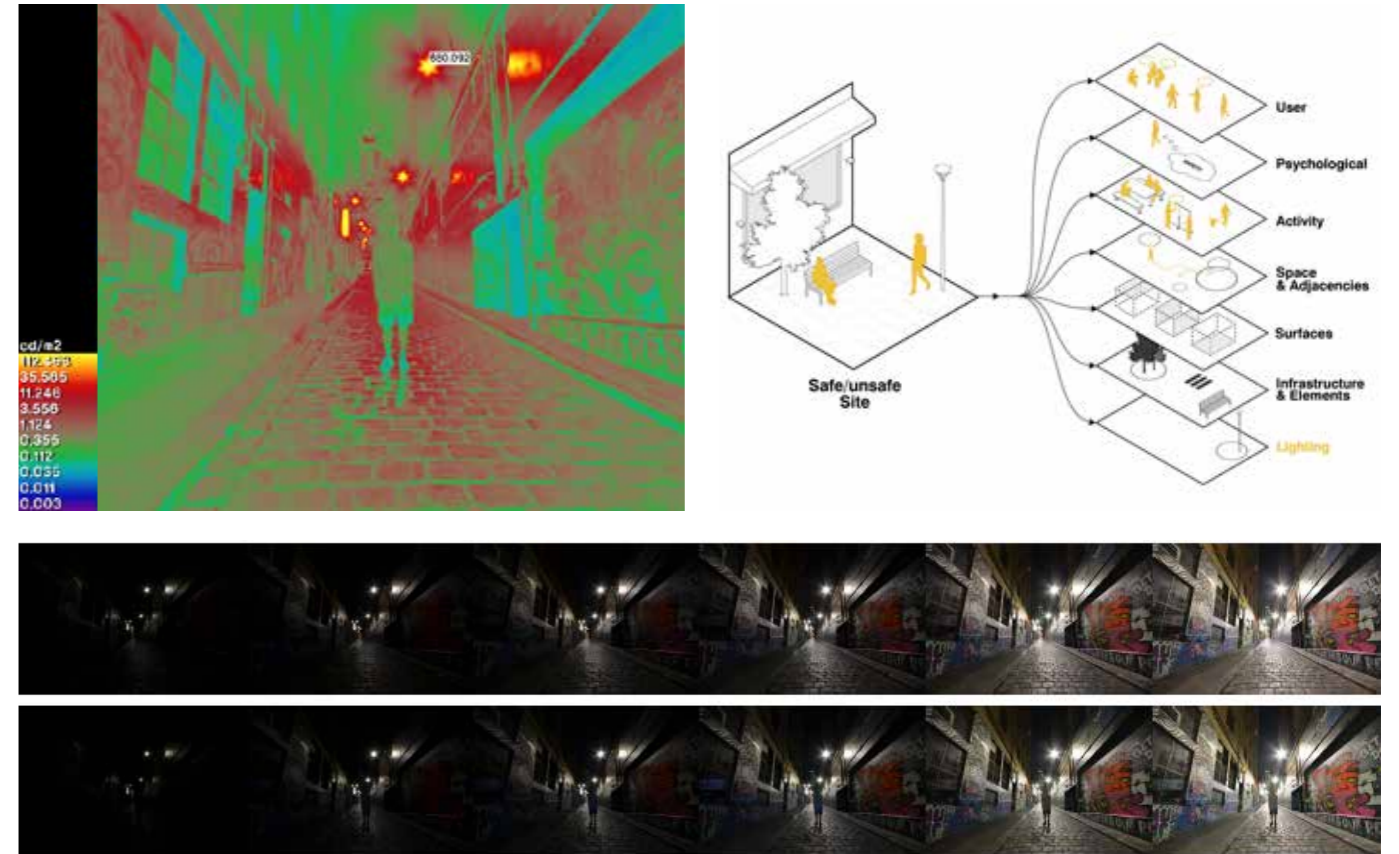


## LaLiga Broadcast Planning Multiple Cities, Spain

Arup was appointed to create an interactive app to enable LaLiga's (Spain's top football division) media partners to test and plan camera locations for each arena. The software, designed by our lighting consultants and digital specialists, considers light levels, glare, and shadow lines for different times of the year. Our predictive tool helps broadcasters better understand the conditions at each stadium with real-time visualisation to inform the final match production for TV audiences.

Tool © Arup

# How can we bring a holistic understanding of creating exciting places and foster safer perceptions at night for everyone?

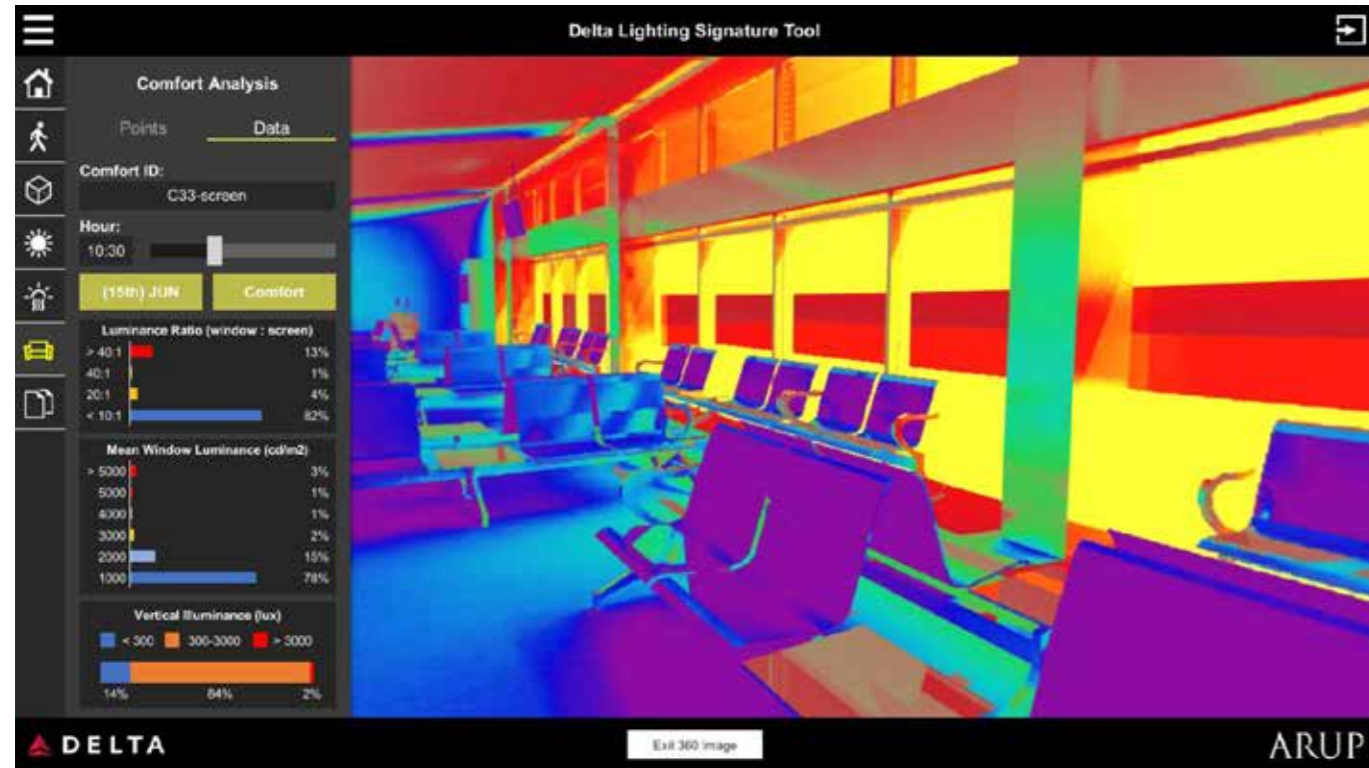


## Lighting Vulnerability Assessment (LVA) Multiple Cities, Australia

The Lighting Vulnerability Assessment is a methodology to diagnose and recommend practical design changes in urban spaces where people feel the least safe. Traditional urban lighting design and masterplanning does not consider the many factors in cities that can affect perceptions of safety at night. Innocuous elements such as trees, windows, colours, and textures can all affect the way we see light and perceive safety. The process assesses how people perceive safety in night-time urban spaces at three scales - contextual, social, and individual. This starts from local context data, pedestrian flow, and drills down to how elements within the architectural and urban context interact with lighting to affect perceptions of safety at night. This is then analysed against a baseline of what a safe perception of space requires to aid with decision making and design strategy.

Photography © Arup

## How can you enhance passenger and employee comfort in an airport terminal while designing sustainably?



### Delta Terminal Atlanta, Georgia, USA

Arup worked closely with Delta Airlines to create an interactive simulation tool that would provide key insights into the visual comfort and occupancy optimization of their Atlanta terminal. A great example of how lighting impacts occupant comfort and can drive improved business performance. Specialty 3D cameras were used to make digital representations of the interior which would create the basis for a comprehensive daylight model. Within the application, stakeholders can easily manipulate time of day to visualise different daylight conditions as well as analyse potential glare risks for employees or passengers. Its success and functionality at Atlanta's International Airport has made it a critical tool for other airports across the nation.

Tool © Arup

## How do you build a skylight system that enhances guest experience and maintains conservation requirements?



### Metropolitan Museum of Art New York, New York, USA

The new skylight design of the ABC wings at the Metropolitan Museum of Art functions to improve daylight quality and meet the lighting conservation requirements. During the day, natural light travels through a series of louvers, creating a soft, diffusing lighting effect below. In the design stages of the project, a daylight scale model was used to visually evaluate the optical performance and physically measure the light levels produced by the skylights. A series of data loggers programmed with lighting analysis software enabled Arup designers to capture large quantities of daylight data over the course of several months and enabled them to make more informed design decisions on glass material, skylight structure, and shading techniques.

Photography © Arup



# 09 Image

LuJiaZui Exhibition Centre  
Shanghai, China

Photography © Kingkay Architectural Photography

A natural desire to fuse image and identity is  
a goal shared by architects, fashion designers  
and businesses alike.



With a strong track record in integrated retail design and branding, we bring confidence, fun and the ability to innovate to the assignments we enter into.

This often results in a sense of playfulness, which is conveyed through our designs. But to align the aesthetics and design philosophy of modern retail brands with an educated public requires more than the traditional approach of simply spotlighting a product. At Arup's lighting studio, our approach is that of corporate identity and brand image encased in clean and neatly finished detail, thoroughly customised for each client.



Saxony, World Square  
Sydney, Australia

Interior designer: Interni Pty Ltd

Lighting design for retail space.

Photography © studio commercial

## OōEli JNBY Headquarters Hangzhou, China

Architect: Renzo Piano Building Workshop

The urban complex OōEli is a superblock of 250,000m<sup>2</sup>, serving as the new headquarters of the Chinese high fashion brand JNBY and the local design institute GOA which also offers arts, retail, working and leisure space for the city of Hangzhou. We made use of exterior lighting to reinforce the identity and experience of the development by providing soffit uplights that create a floating effect and guide the visitors toward the central courtyard. We also provided electric lighting design for key public spaces of the interior. Office space is lit by an array of glare-free downlights and core walls cast in concrete are illuminated with concealed linear lighting.

Photography © Kingkay Architectural Photography, JNBY





**Library and Learning Centre,  
University of Economics  
Vienna, Austria**

**Architect:** Zaha Hadid Architects

The Library and Learning Centre as part of the new Vienna's University of Economics Campus is shaped as a strong sharp-edged volume. Through a number of incised canyons, the building's interior is clearly divided into two parts, containing both library and administration services. The lighting reinforces the interplay of different functions within the building by illuminating each of the diverse spaces in a distinct way, as well as with subtle changes of colour temperature.

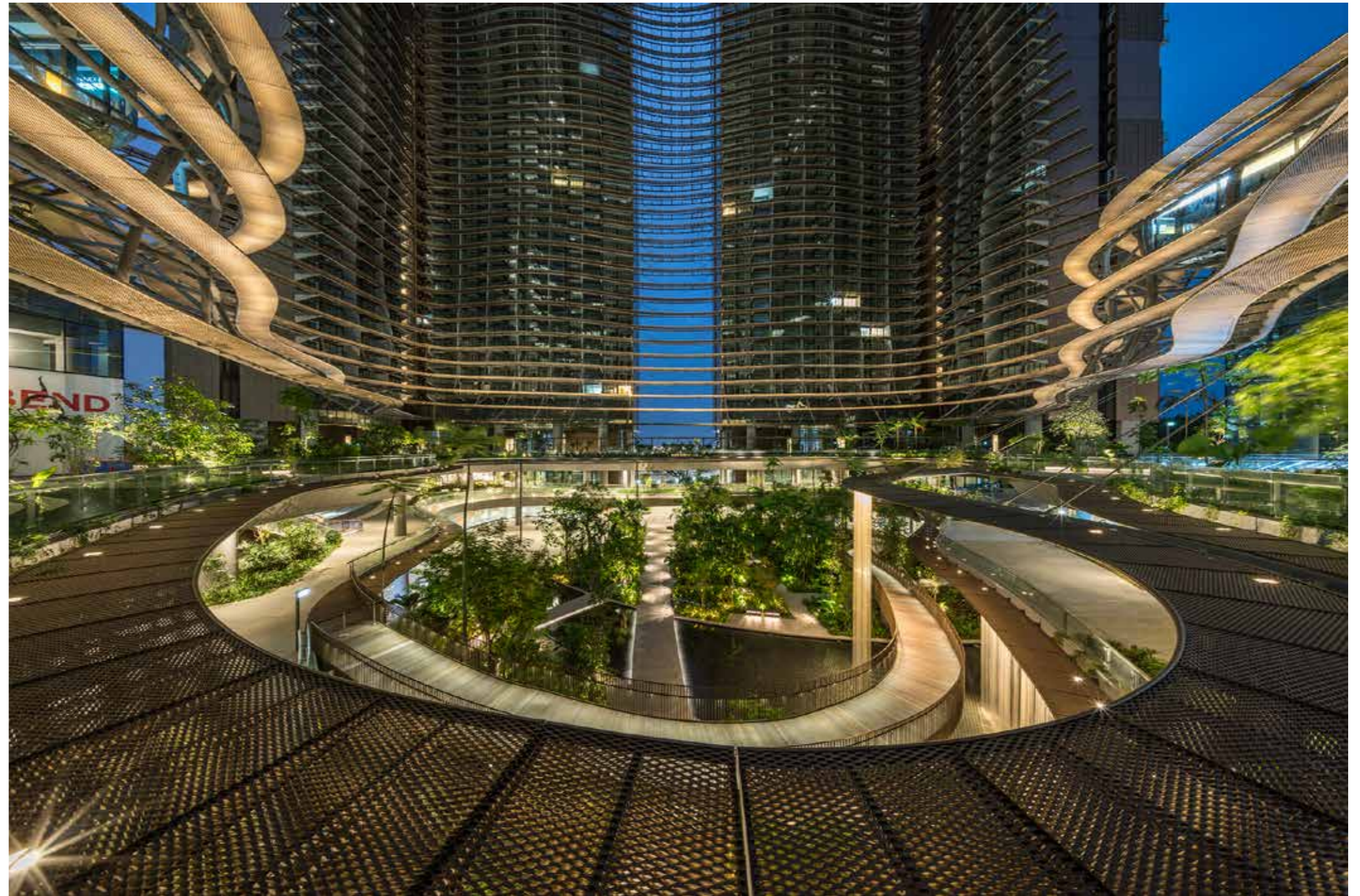
Photography © Ulrich Rossmann

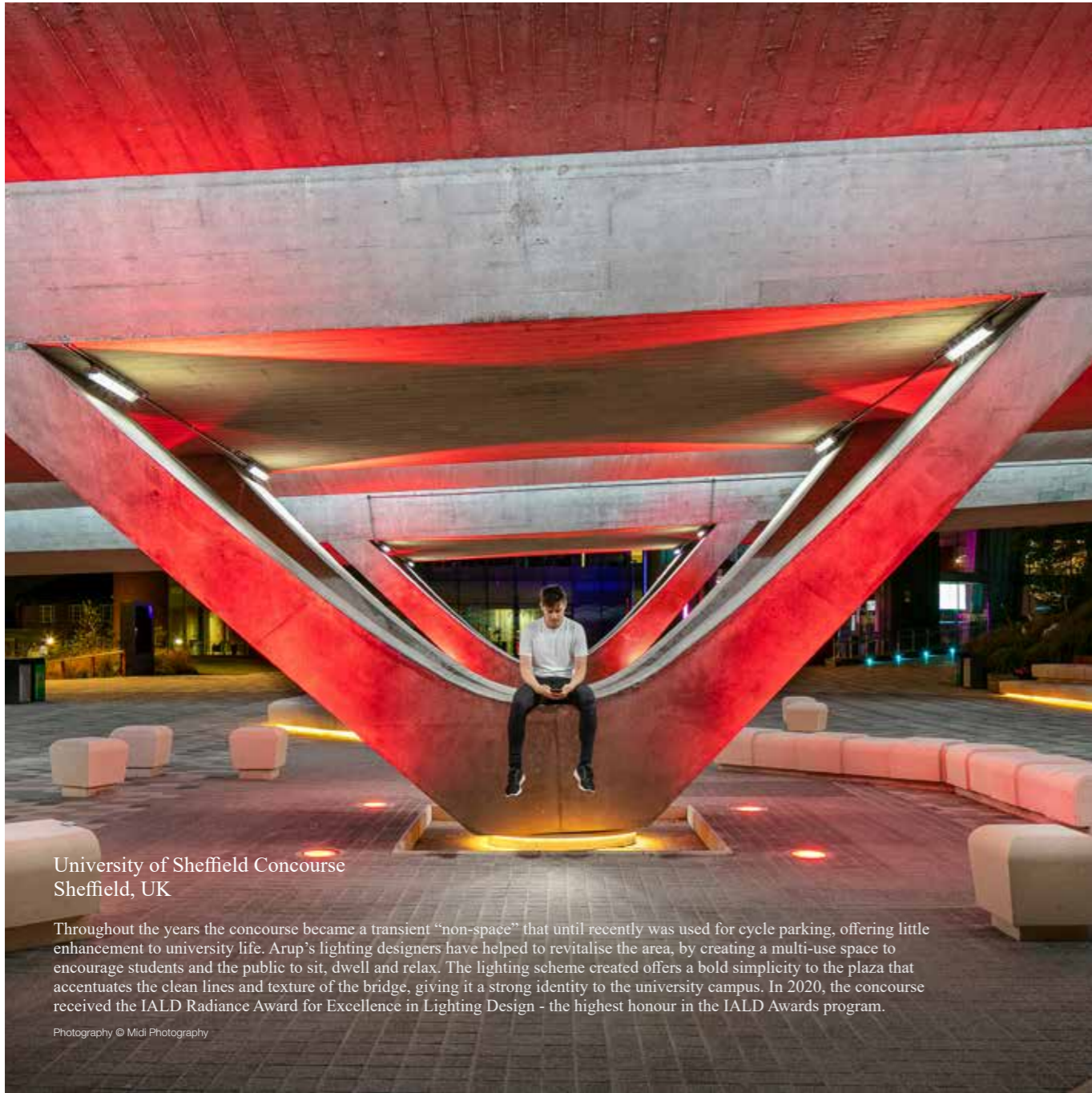
# Marina One Republic of Singapore

Architect: Ingenhoven Architects

Marina One is a mixed-development situated in the prime central business district of Singapore. Set to be the defining icon of the Marina South area, it offers lush green biodiversity at the heart of the development. Arup's lighting concept for the "Green Heart" builds a warm hierarchy and striated intensity growing upwards and outwards from the core. While the external façade lighting exudes a formal and architectural character, the Green Heart offers a sense of safety and an inspiring energy.

Photography © Darren Soh





University of Sheffield Concourse  
Sheffield, UK

Throughout the years the concourse became a transient “non-space” that until recently was used for cycle parking, offering little enhancement to university life. Arup’s lighting designers have helped to revitalise the area, by creating a multi-use space to encourage students and the public to sit, dwell and relax. The lighting scheme created offers a bold simplicity to the plaza that accentuates the clean lines and texture of the bridge, giving it a strong identity to the university campus. In 2020, the concourse received the IALD Radiance Award for Excellence in Lighting Design - the highest honour in the IALD Awards program.

Photography © Midi Photography



“The approach has brought fantastic new life and vibrancy to the area, enhanced the form and structure of the feature bridge, and created a flexible and creative way to light this impressive space.”

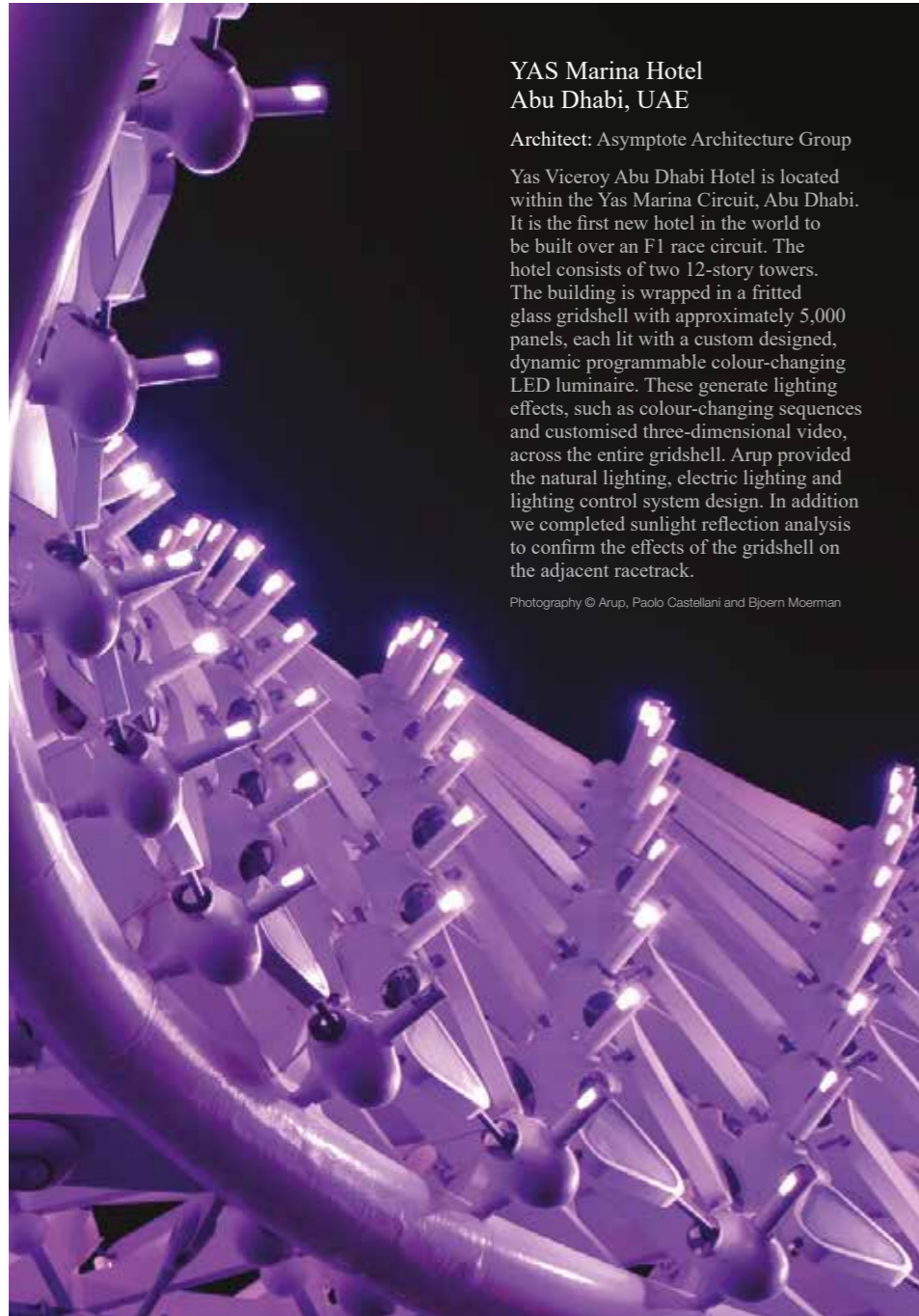
Keith Lilly, Director of Estates at University of Sheffield



**Stonecutters Bridge**  
 Hong Kong, China

As the sun sets, the narrative lighting scenes add a sense of magic and invite the viewer to return to encounter a different, yet fascinating, experience of a bridge. Our design approach to the architectural lighting reflects the unique characteristics of Hong Kong, regarded as dynamic and cosmopolitan, a place which offers a diversity of experiences, blending Chinese heritage and British colonial influence. The simple yet elegant lines of the Stonecutters Bridge are picked out with crisp cool white light to reinforce their beauty and the simplicity of the bridge structure against the backdrop of Hong Kong's vibrant skyline. The cross fading of colour lighting in the light strips and tower beacons, controlled by Digital Multiplex technology, is programmed to express the characteristics of the city with special light show on festive occasions.

Photography © Arup and Marcel Lam

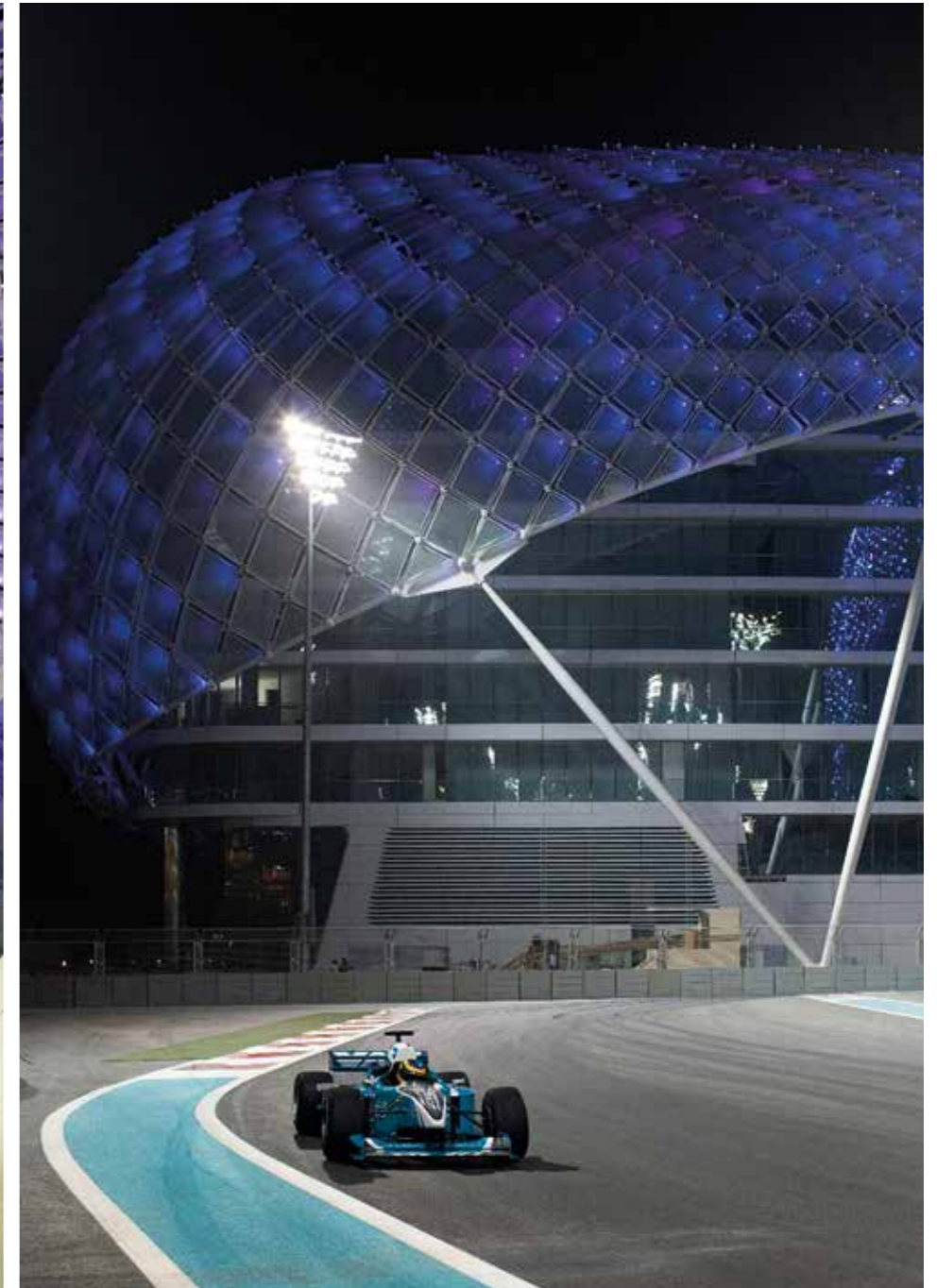
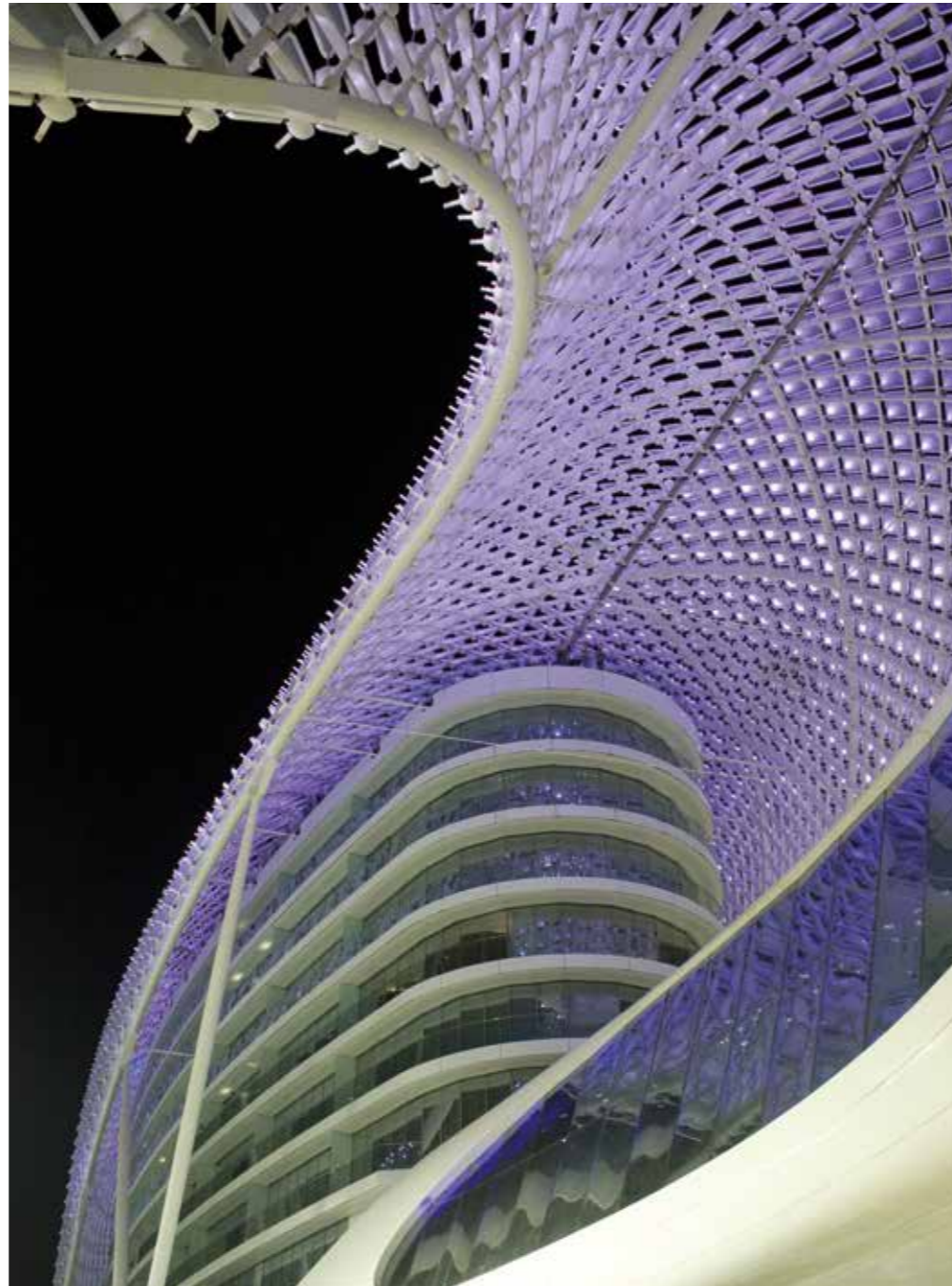


## YAS Marina Hotel Abu Dhabi, UAE

Architect: Asymptote Architecture Group

Yas Viceroy Abu Dhabi Hotel is located within the Yas Marina Circuit, Abu Dhabi. It is the first new hotel in the world to be built over an F1 race circuit. The hotel consists of two 12-story towers. The building is wrapped in a fritted glass gridshell with approximately 5,000 panels, each lit with a custom designed, dynamic programmable colour-changing LED luminaire. These generate lighting effects, such as colour-changing sequences and customised three-dimensional video, across the entire gridshell. Arup provided the natural lighting, electric lighting and lighting control system design. In addition we completed sunlight reflection analysis to confirm the effects of the gridshell on the adjacent racetrack.

Photography © Arup, Paolo Castellani and Bjoern Moerman





## Matsubara City Library Osaka, Japan

Architect: Maru architecture

Known as the 'Forest of Reading', the library is modelled on historical Japanese tumulus: large burial mounds surrounded by moats found in Matsubara city and its surrounding areas. Our lighting design creates varying impressions for each area while highlighting the outer concrete wall with cove lighting. Glare-free downlights are arranged according to the positions of the bookshelves to maximise vertical illuminance on the books. Reading areas are equipped with table lamps to supplement illuminance and enhance visual brightness.

Photography © Kai Nakamura

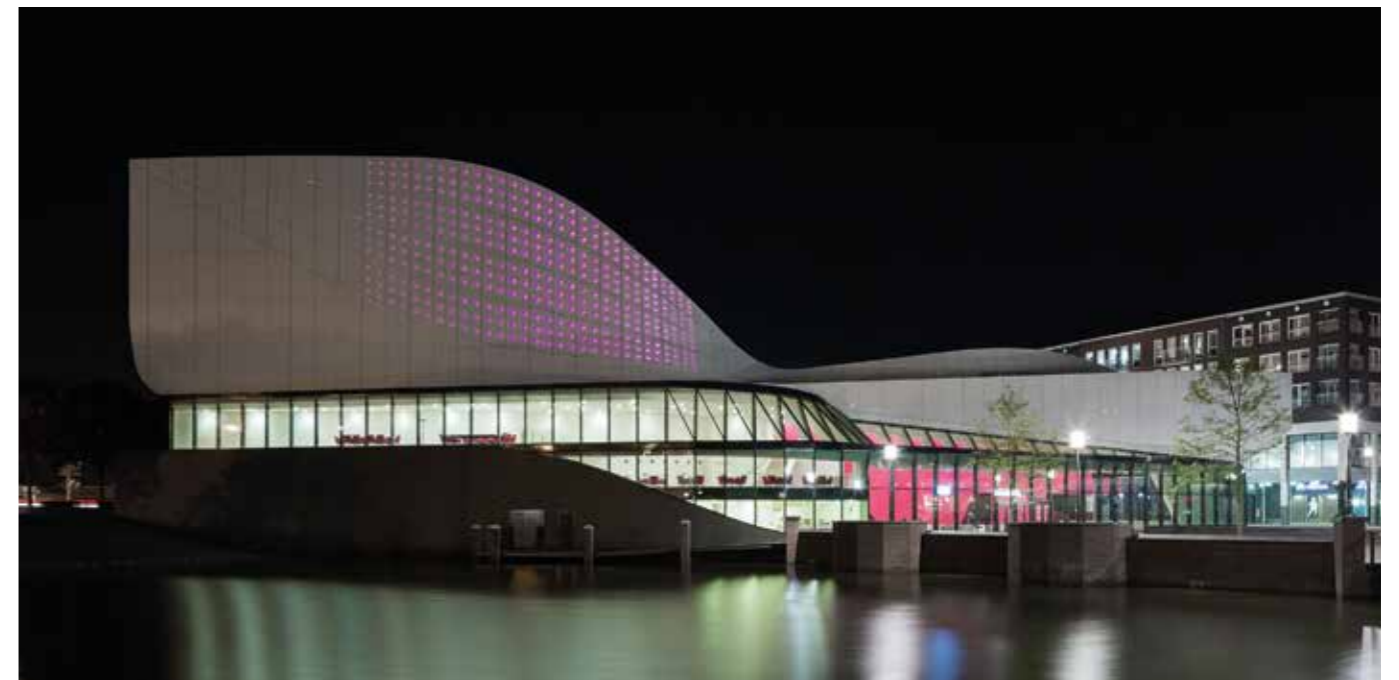


### Theatre 'De Stoep' Spijkenisse, The Netherlands

Architect: UN Studio

This theatre with a large hall (650 seats) and a small hall (200 seats) is a striking building with an open character; the entrance and foyer form a seamless continuation of the city square. The light radiating through the perforations in the roof and walls gives the theatre a warm glow at night. The soft 'lantern effect' is achieved by illuminating the space between the roof and the perforated metal skin.

Photography © Christian Richters



# Contact

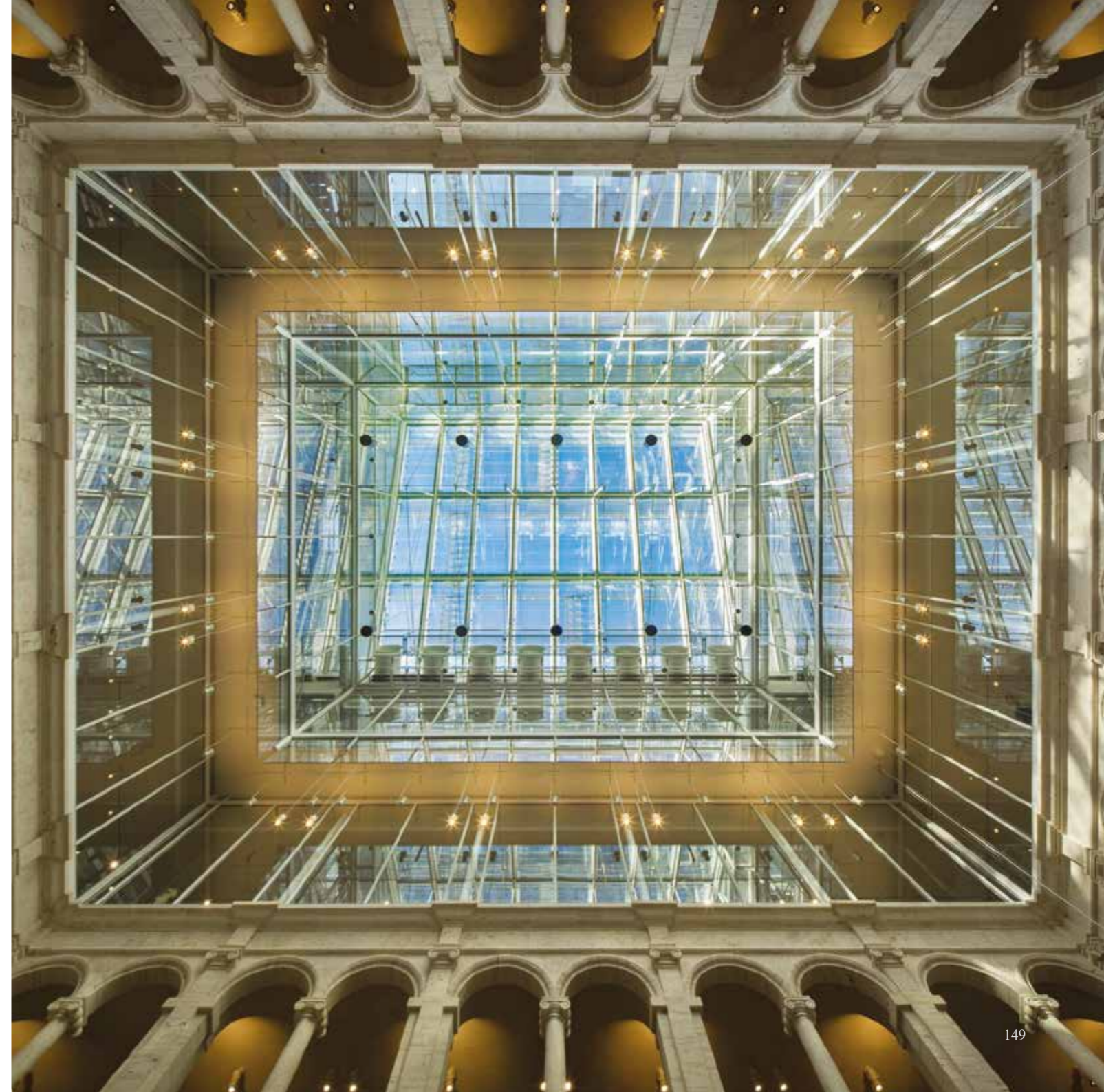
e: [lighting-design@arup.com](mailto:lighting-design@arup.com)  
[www.arup.com/lighting](http://www.arup.com/lighting)

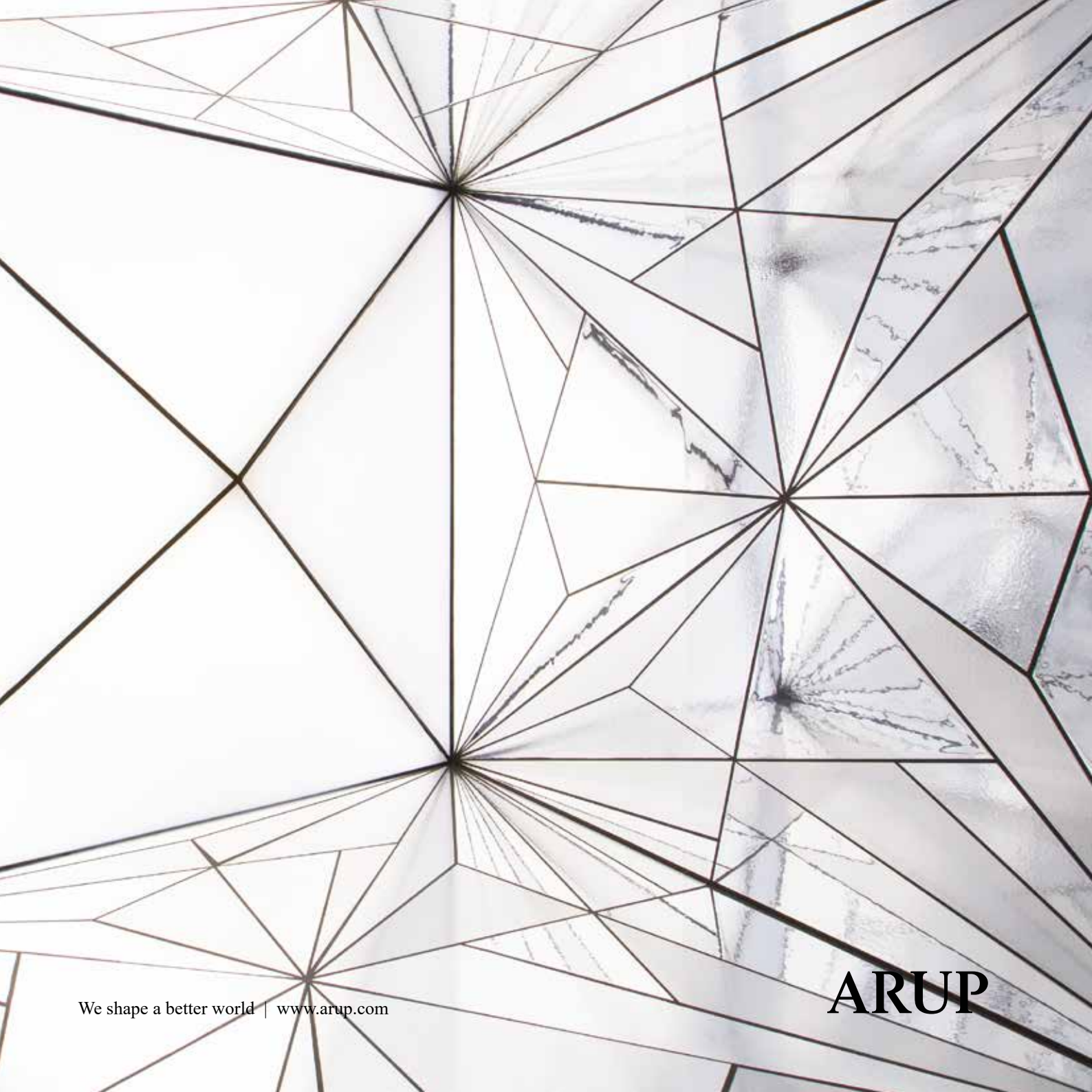
## About Arup

Arup is a global firm of planners, designers, engineers and business consultants. We provide a diverse range of professional services to clients around the world, exerting a significant influence on the built environment. The firm is the creative force behind many of the world's most innovative and sustainable building, transport and civil engineering projects and design technologies.

Established in 1946, Arup has over 15,000 employees based in more than 89 offices across 33 countries, working on up to 10,000 projects at any one time. Its unique structure, with the firm held in trust on behalf of its employees, gives us complete independence.

Inside cover image: Harvard Art Museums, Cambridge, MA, USA  
Photography © Nic Lehoux





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