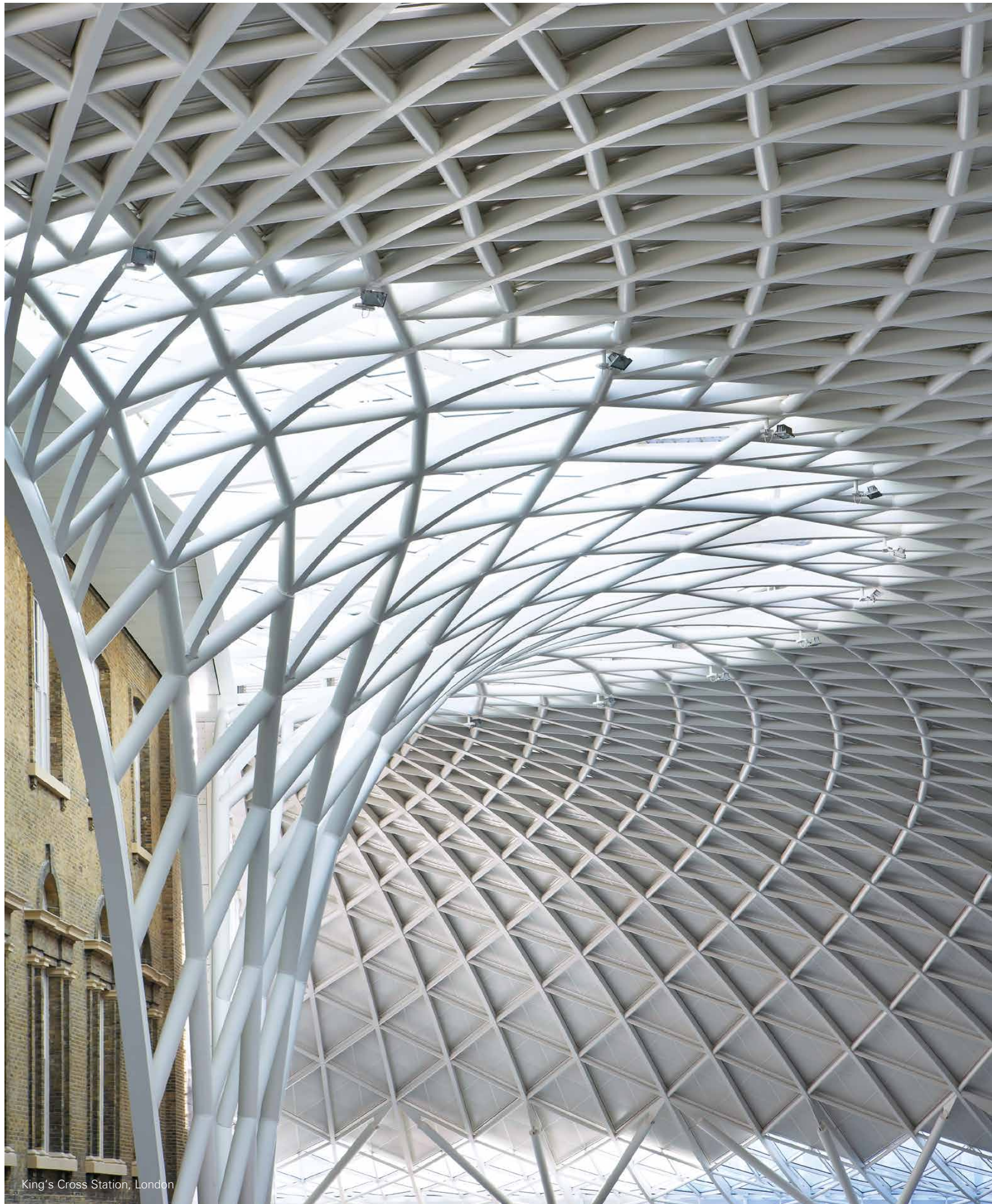


seele



King's Cross Station, London

bold façade concepts need the expertise of seele to turn them into reality. we see our profession as working closely together with clients and architects to create lasting value. our knowledge of materials, production technologies, and innovative façade engineering paves the way to new answers. for steel-and-glass designs, unitised façades, structural glazing and membrane structures. it is precisely the complex tasks that are the driving force behind our creativity and ingenuity. and all with just one aim: the perfect realisation of superlative architecture.



great cities such as london, new york, berlin or hong kong attract the attention of the world's best architects and developers. seele projects set standards, and combine fascinating aesthetics with outstanding functionality.



5 Broadgate, London

Architect Make Architects, 2015

The development at 5 Broadgate looks like the shiny steel of an engine block. Situated in the heart of London, this new headquarters for a major bank serves as the hub for the bank's stock market activities and provides jobs for about 6,000 employees. Smaller blocks have been "cut out" from this compact, metal-clad structure to create recesses, light wells and atria.

The challenge with the façade for the King Abdulaziz Center for World Culture in Saudi Arabia was not just the organic form of the building, which is reminiscent of giant pebbles, but the fact that the external cladding also has to withstand the severe sandstorms and extreme heat of this region. Thus, seele had to think in new dimensions. Not just in terms of materials, but also production processes and construction logistics. The final façade, an area of 30,260sqm, is made up of 350km of stainless steel tubes bent in three dimensions – a solution as uncompromising and enduring as the desert itself.

how to manage a façade and the desert to function on the same wavelength?

King Abdulaziz Center for World Culture, Dhahran, Saudi Arabia

SAUDI ARABIA

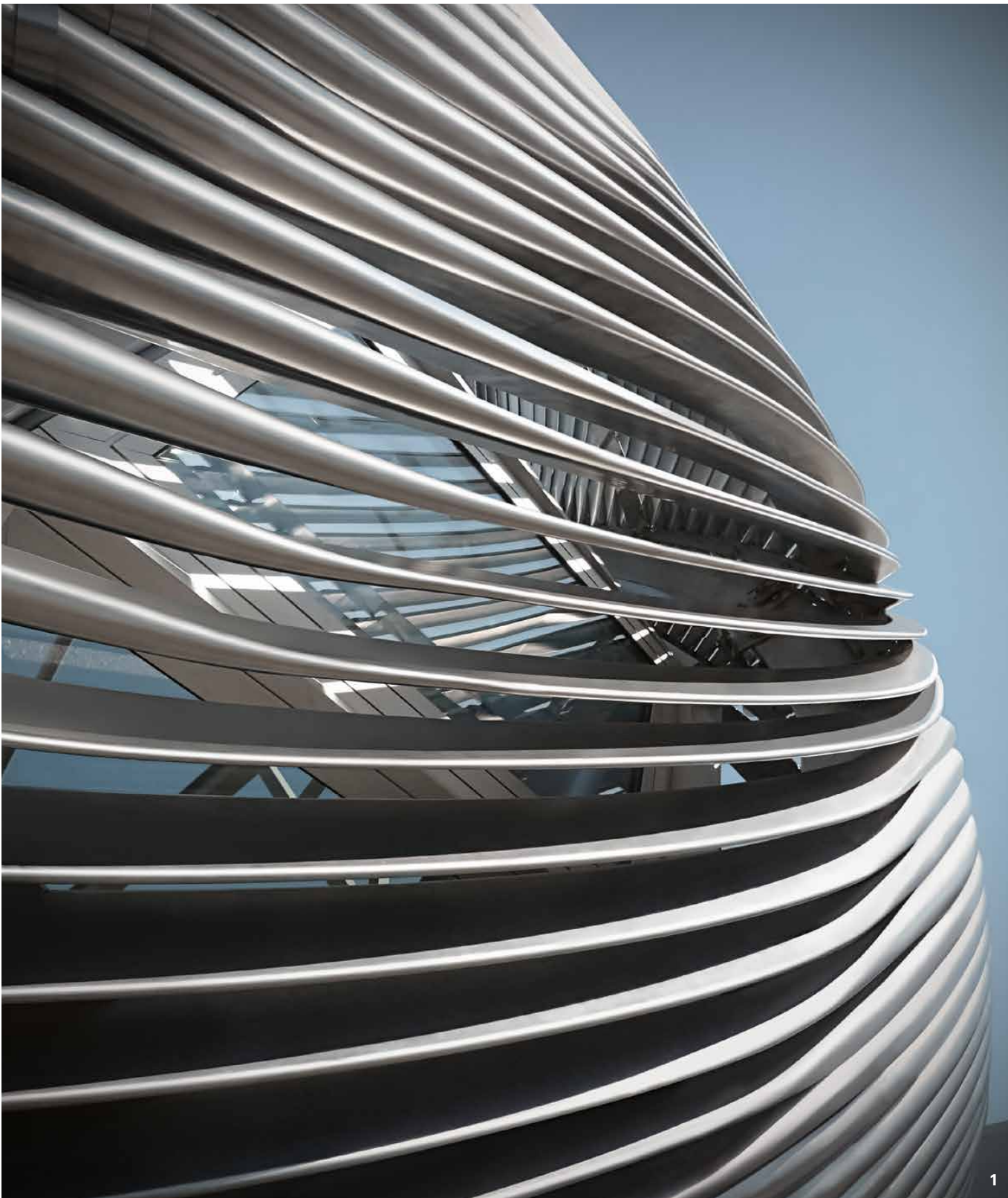
stainless steel façade



King Abdulaziz Center for World Culture, Dhahran, Saudi Arabia

Architect Snohetta, 2016





The King Abdulaziz Center for World Culture is all about superlatives. The external cladding is comprised of 70,000 tubes made from grade 1.4462 duplex steel, each with a diameter of 76.1mm and a wall thickness of 1.5mm. Despite the huge area of more than 30,000sqm, seele was able to specify the distance between the triple-curvature tubes as exactly 10mm throughout. This precision work is the key factor behind the impressive homogeneity of the “pebbles” that make up this centre. However, the machines needed for the precision work had to be developed first. Based on individual data files and accurate 3D data, each tube was bent individually on complex bending machines.

ACCURATE IMPLEMENTATION



Steel-and-glass designs



THE PRECISION OF INDUSTRY 4.0

1/2 Diagonal, horizontal and vertical window strips criss-cross the tower. Viewed from outside, these openings appear as dark slashes contrasting with the homogeneous texture of the building envelope. The stainless steel tubes were pressed flat in these zones.

3 Via an integral measuring system, the bending machines independently developed new algorithms which were then used as the basis for performing each bending process.

4 Following bending, the end diameter of each tube was tapered from 76.1 to 69mm.

A well-designed building envelope never lets you down, even under extreme conditions. seele researches the forces a façade has to withstand in its own test centre. During intensive testing, seele fires water, wind and metal at full-scale mock-ups to assess their suitability for demanding locations. So did seele for the 260m long, 7,080sqm steel-and-glass roof for Chadstone, Australia's largest shopping centre in Melbourne.

our glass has to pass tough tests before emerging to a façade.

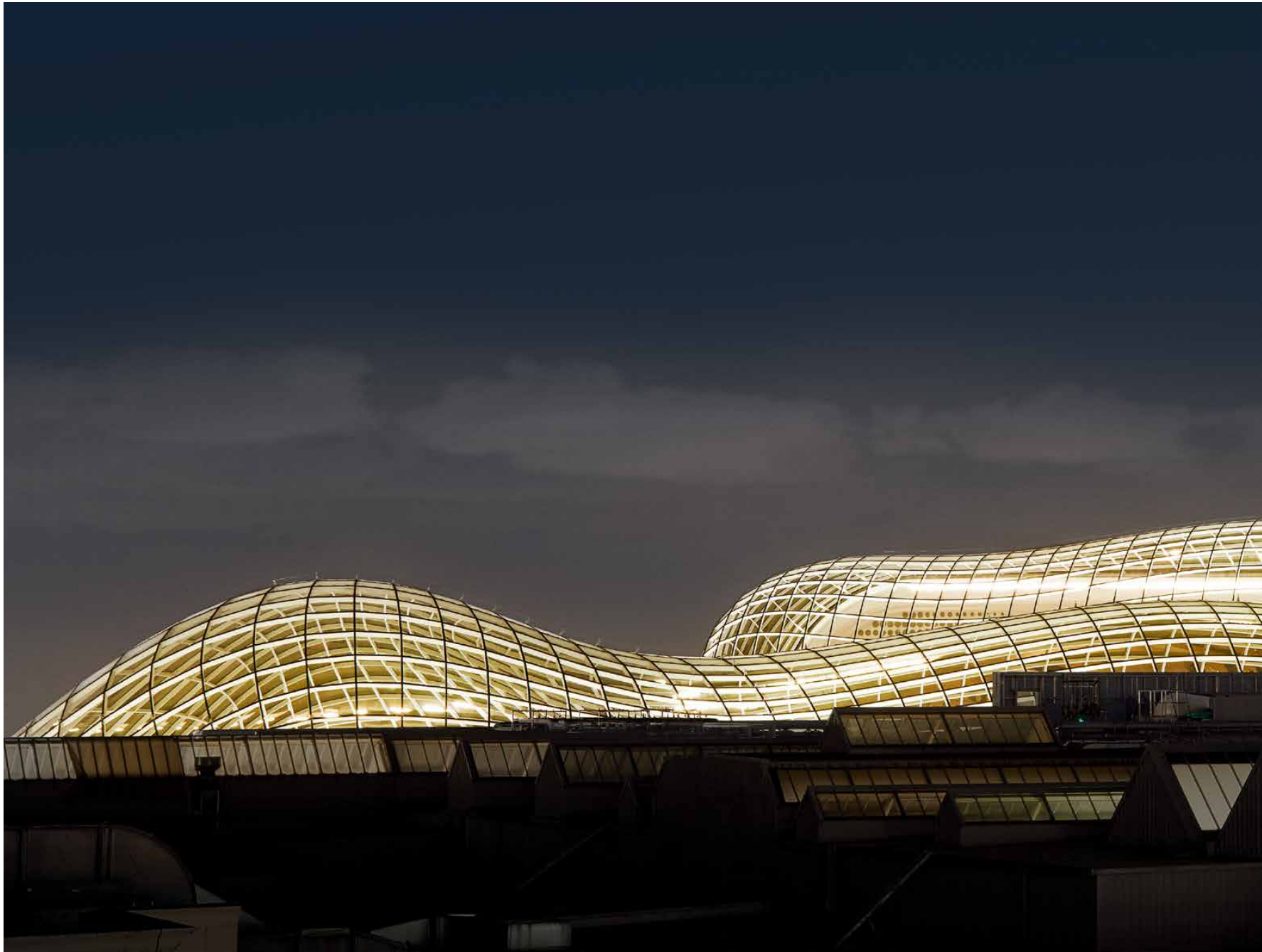
Chadstone Shopping Centre, Melbourne, Australia



free-form shell structure



Steel-and-glass designs



a wave of enthusiasm made of 2,672 insulating glass panes.

Chadstone Shopping Centre, Melbourne, Australia

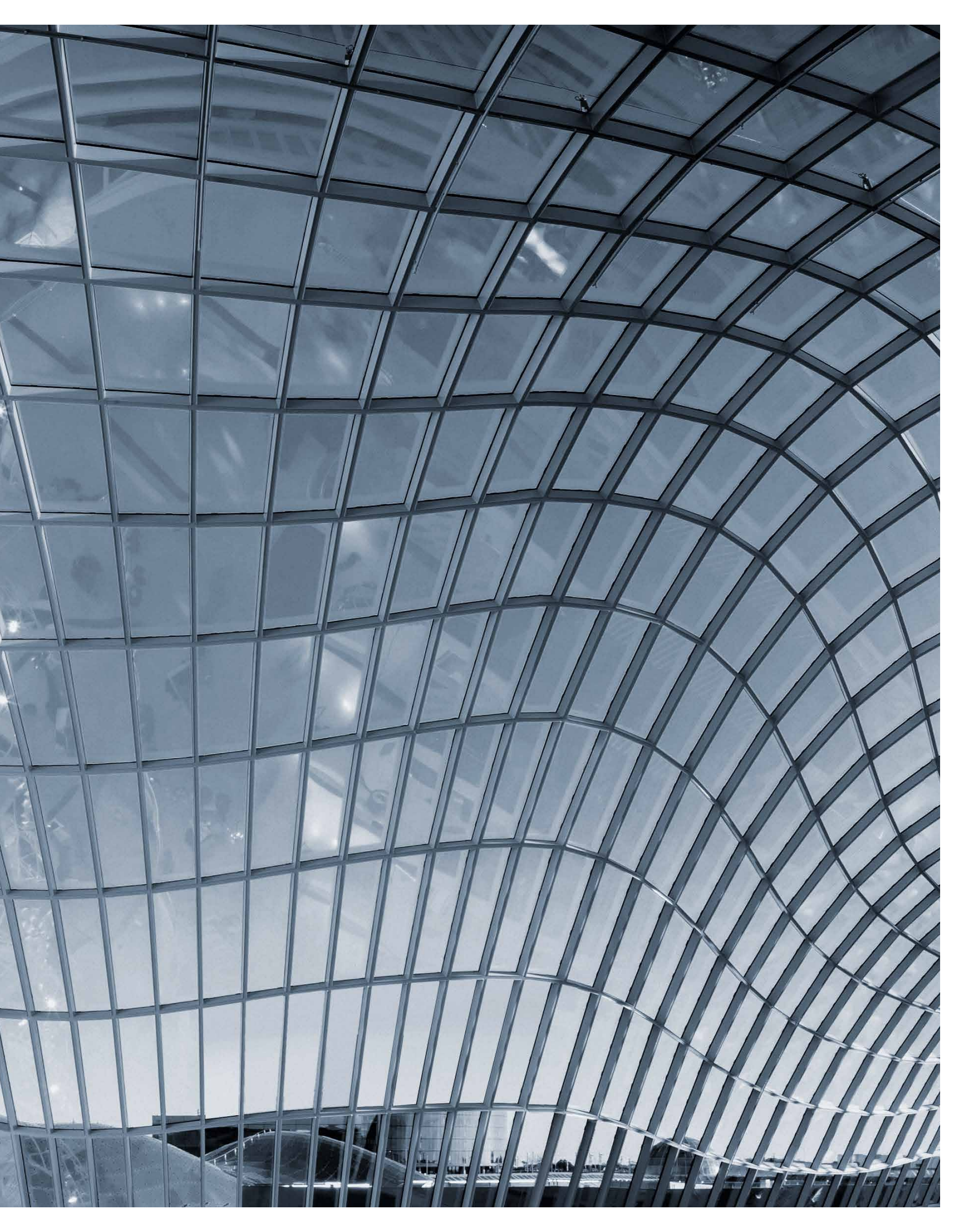
All planning data was parameterised, so changes to the design could be carried out easily, even at short notice. The complete free-form steel-and-glass structure is made up of about 105,000 separate parts. In order to manage this huge number efficiently, the structure was divided into 22 sectors for design, production and erection.



Architect Global Architectural Practice Callison RTKL, 2016

With spans of up to 44m, the free-form roof of steel and glass was a real challenge. Even more in Melbourne, where buildings frequently have to withstand strong winds and extreme heat. However, a clever construction concept ensured that the roof was economically viable and ready on time. A total of 2,810 steel nodes, 5,168 steel rods and 54 edge beams were fabricated and delivered to Australia in twelve months. Pre-assembly of large elements took place off-site. A strict logistics timetable ensured fast erection.





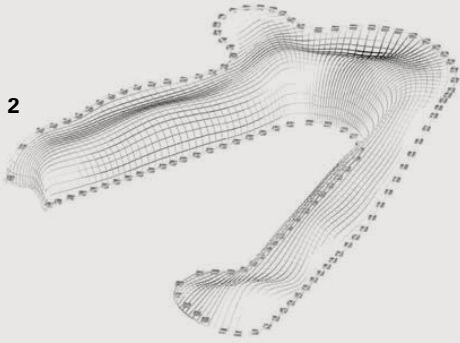


FLOWING FORMS

1 seele installed a total of 2,672 cold-bent insulating glass panes with sizes ranging from 1.2 to almost 8sqm above the multi-storey retailing areas. The configuration of the panes takes into account both the thermal performance in summer and the hail resistance required, as the number of hailstorms recorded in Australia's cities has risen in recent years.

Very high temperatures and frequent strong winds affect construction progress in Australia. With a glass roof of this length – 260m in some places – deformations of up to 135mm are possible if the thermometer climbs above 35°C. It is therefore vital that the supports for the glass roof on the building not only withstand the heavy load of the roof, but also include a sliding detail to accommodate the huge deformations caused by temperature fluctuations.

2



2 seele paid particular attention to the climatic conditions of the site and developed a 3D model to simulate the high loads on the glass roof and the deformations caused by temperature fluctuations.

3 The pre-assembled roof components were delivered to site on trucks, where, one by one, they were quickly lifted into place and fixed.

4 Strong winds frequently prevail at this location, but the fast timing of the final erection prevented a disruption of the schedule.

5 Pre-assembly of all parts outside Melbourne took only 20 days. Final erection on site was completed in 143 days.



3



4

Steel-and-glass designs

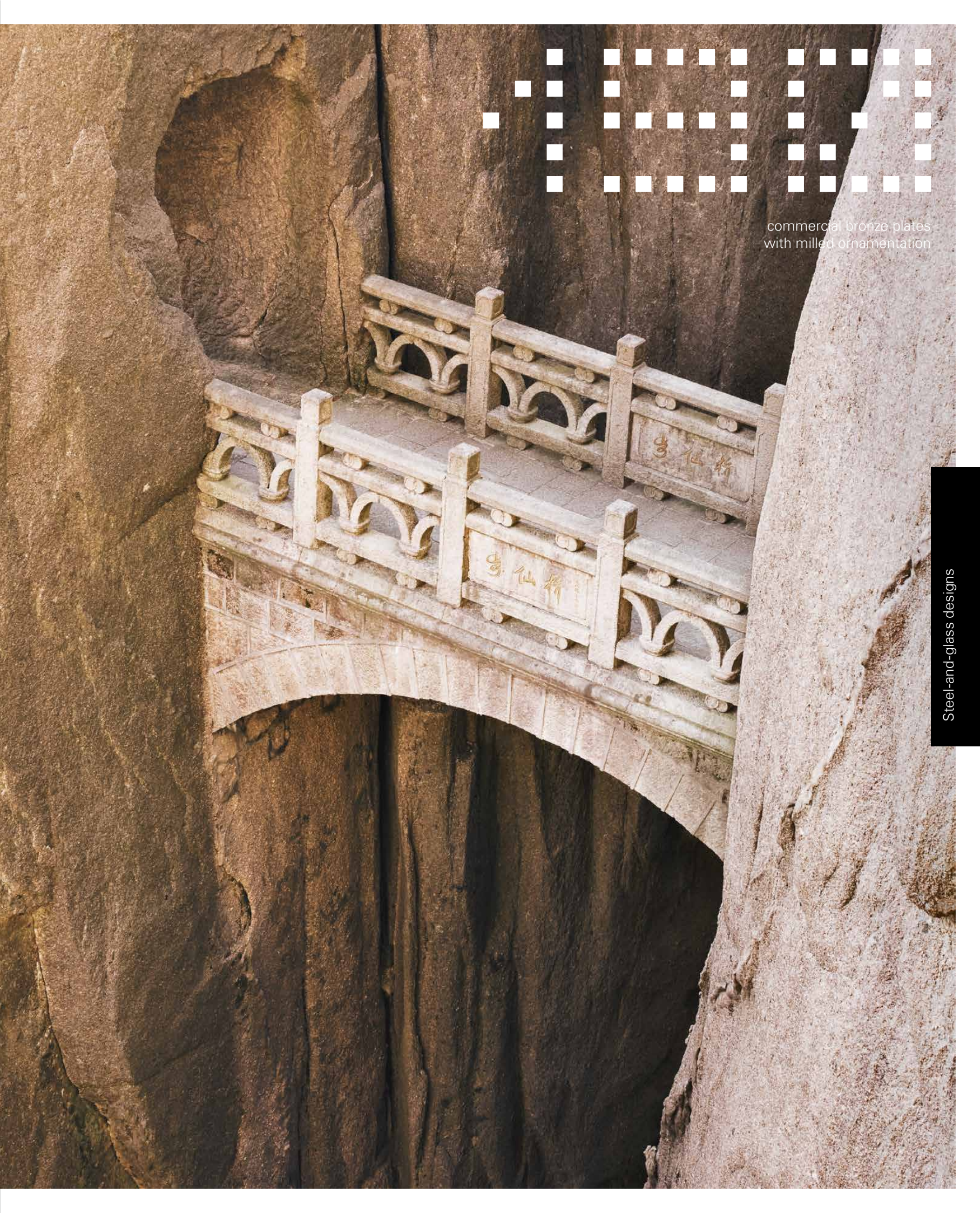


5

**the shortest connection from a to b is a straight line.
plenty of room for precision and aesthetics.**

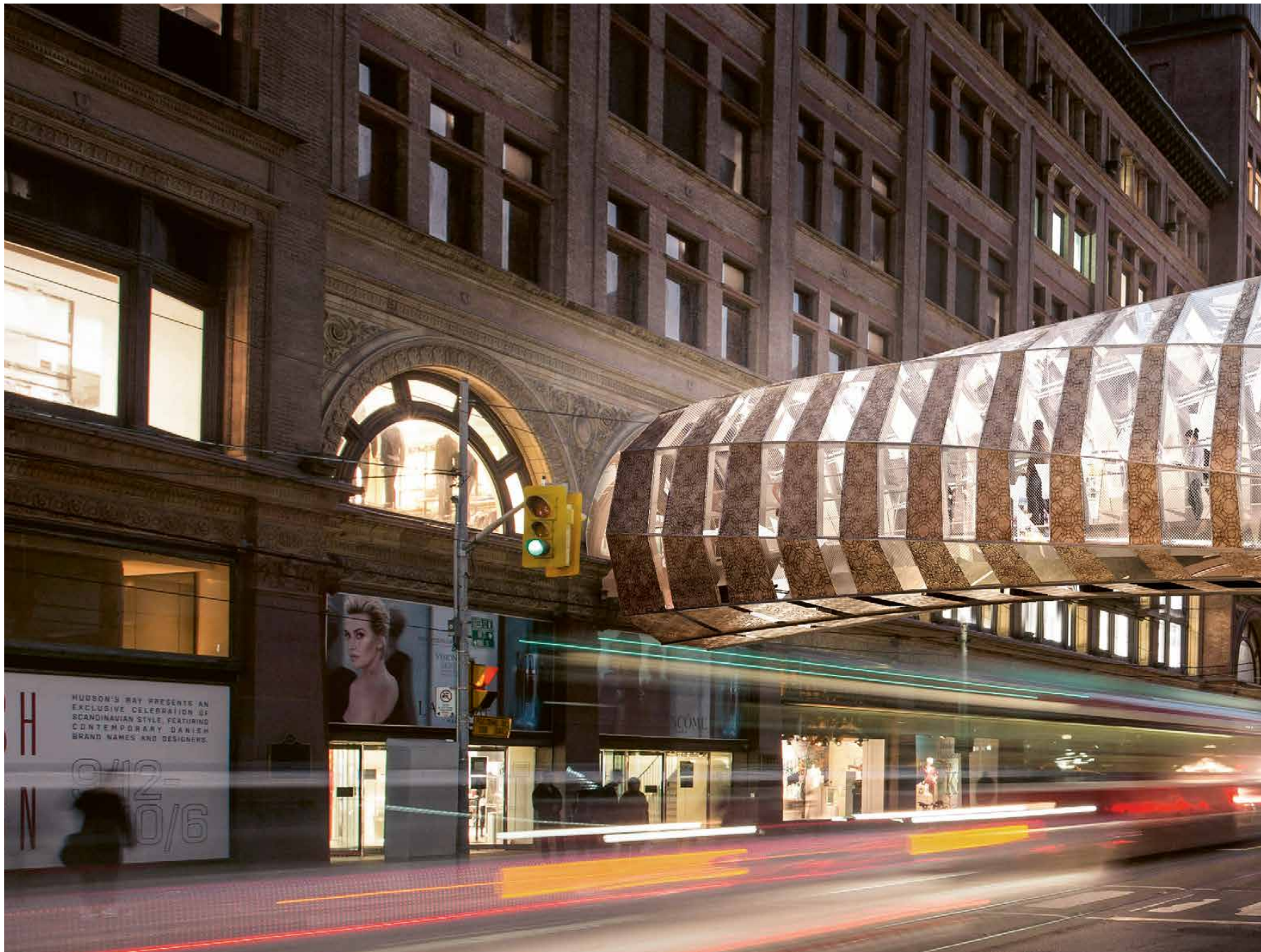
TEC Bridge, Toronto, Canada

A bridge turns a journey into an experience – whether the path itself is the goal, or we simply need to reach the other side. Since mankind learned to build, constructors have tried to transcend gravity in unique and elegant ways – using technical ingenuity and innovative materials. Bridges are thus crossings in more than one sense. In Toronto, Canada, seele has created just such a crossing. It crosses over directly to the building opposite and to a new era.



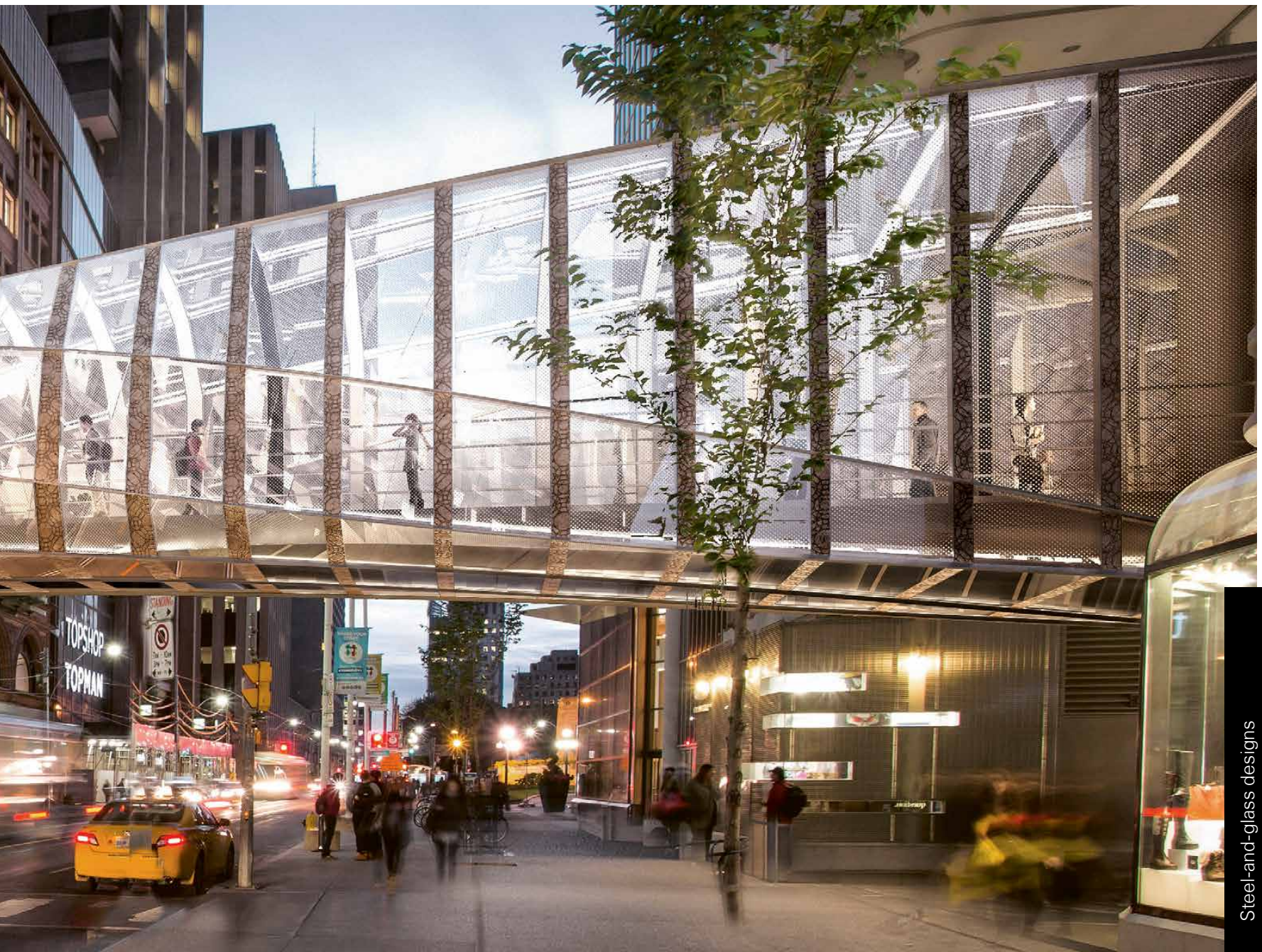
commercial bronze plates
with milled ornamentation

Steel-and-glass designs



**from side to side.
from square to polygon.**

TEC Bridge, Toronto, Canada



Architect Wilkinson Eyre Architects & Zeidler Partnership Architects, 2017

The TEC Bridge swaps symmetries and constants for dynamic transformation, allows buildings to coalesce. With the help of a fascinating lightweight design and exciting contrasts between glass and commercial bronze, seele has created a stunning, unique structure. Another success was the brilliantly conceived site logistics. In one piece and on just one night, the 35m long bridge was transported around street corners on a modular vehicle and finally lifted successfully into place between the Hudson's Bay Shopping Mall and the Toronto Eaton Centre (TEC).

EXPERTISE IN MATERIALS



Competence in materials for ultimate shaping skills. Visually, the steel portal frames of the TEC Bridge, clad with 190 commercial bronze plates, and the 300 twisted panes of laminated glass form a flowing transition. The initially skewed portal frames at one end merge into a stricter glass design language that blends in with the modern architecture of the TEC building at the other end. Accordingly, the form of the steel-and-glass bridge proved to be challenging. Every commercial bronze plate produced and milled by seele is a one-off in terms of its geometry and machining.

1 The production of the 190 commercial bronze plates with milled ornamentation was carried out by seele at its plant in Gersthofen. The production technology was coordinated with the machining of the commercial bronze, and the machines developed especially by us.

2 The circular ornamentation was milled into the commercial bronze plates first before treating them in an acid bath to achieve the bronze-coloured patina.



3 Following overnight preparations, the bridge was lifted early the next morning and transported from James Street to Queen Street West.

4 Millimetre precision: Lifting, turning and exact positioning of the 35m long bridge proceeded without a hitch.

5 Successful installation: Once the TEC Bridge was securely anchored, further work could be carried out without disrupting road traffic.



PERFECTION IN ENGINEERING



6 The mock-up section on seele's testing grounds in Gersthofen – a 3m long TEC Bridge segment halved vertically. Both the design and the erection could be tested on the mock-up.

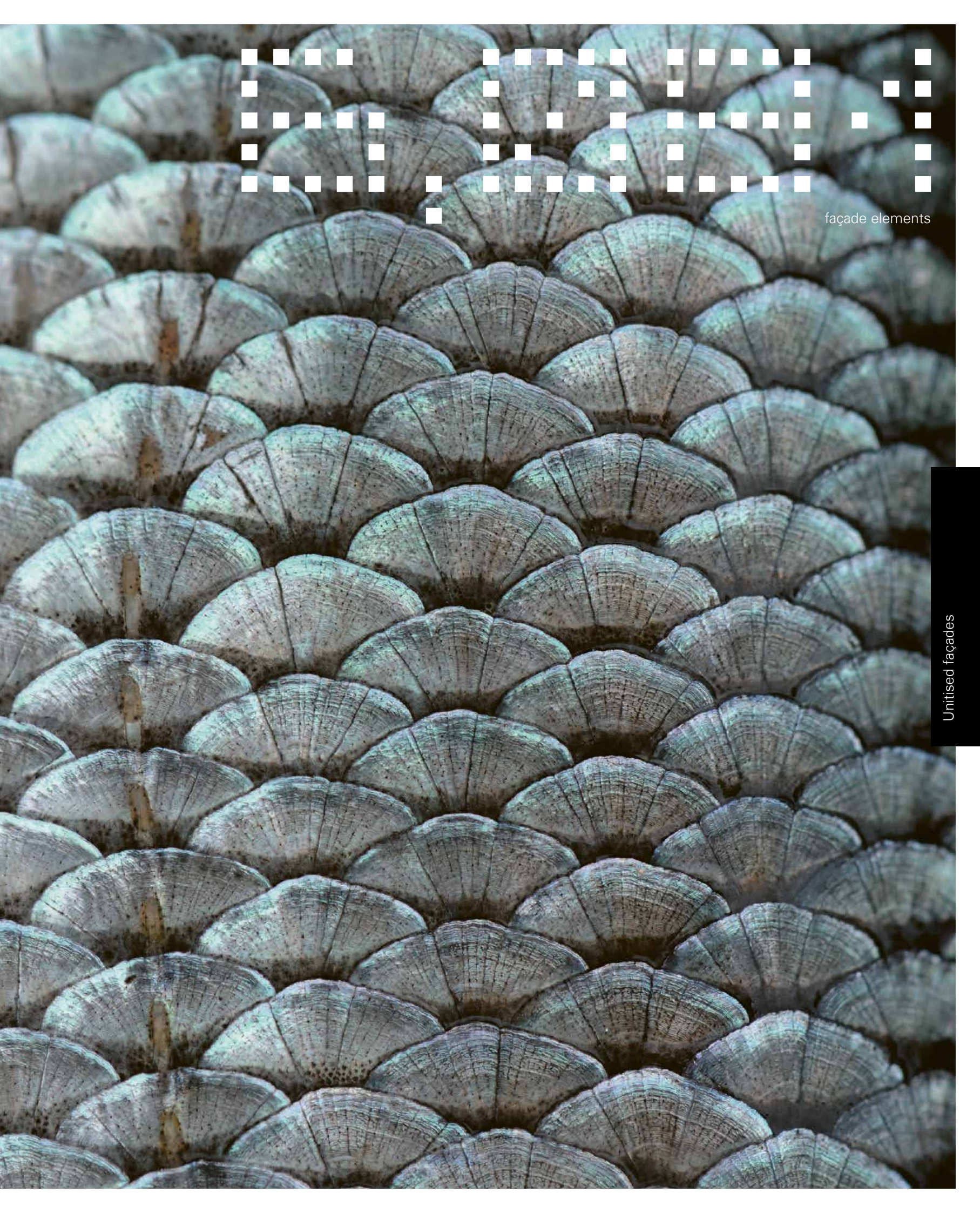
An example of the art of engineering from design right through to completion. The 35m long TEC Bridge was initially pre-assembled in a side street to avoid unnecessary traffic chaos and costs. Another part of the comprehensive concept was the detailed planning of the smooth transportation plus the fitting of the bridge between its supports on the two buildings – Hudson's Bay Shopping Mall at one end and Toronto Eaton Centre (TEC) at the other.

OPTIMISATION THROUGH FULL-SCALE MOCK-UP

the strength of the entity grows out of the ingenuity of the single element.

European Central Bank, Frankfurt, Germany

A complex façade form does not necessarily have to be expensive. Elements cleverly designed and combined by seele follow a different line, achieving more at lower cost. The best example of this are the hyperbolic façade surfaces of the European Central Bank in Frankfurt. Despite the individual symmetry of the 6,081 façade elements, seele developed a system that enabled serial production, and thus reduced the work and the costs considerably.



façade elements

Unitised façades



European Central Bank, Frankfurt, Germany

Architect Coop Himmelb(l)au, 2014





1 The ECB headquarters consists of two slender towers. The sloping roof form and 34,200sqm unitised façade by seele ensure offices flooded with light.

2 Positioning the elements next to each other like scales resulted in a homogeneous, curving surface without corners, projections or recesses, despite the use of exclusively straight panels. Asymmetric elements were only needed along the curving edges of the towers.



seele managed to achieve an economic and practicable solution for building this unusual façade design. The answer was to mount the elements at an angle of 2° to their vertical axis. This scale-like arrangement has resulted in a perfectly homogeneous appearance. seele was therefore able to assemble the curving façade surface without using any asymmetric panels. That reduced the number of different element formats required from 4,000 to about 1,000, and at the same time enabled economical serial production plus simpler logistics.

**in the past, glass always needed something
to hold it. we've changed all that.**

Gravity doesn't sleep. We all know that. To defy gravity, in the past glass structures had to be supported by other materials. Metals, for instance. seele has given glass new capabilities. These days, fixings are invisible, even obsolete. Glass supports itself – as walls, stairs or bridges. seele turns glass into a flexible design element for a new, purist idea of space – outside becomes inside, inside becomes outside. So, it is no wonder that an innovative company such as Apple relies worldwide on the fascination of glass made by seele.

W E S T

large-format glass panes



1 The architectural icon on 5th Avenue, designed and built by seele in 2011, exploits the latest developments and innovations in glass construction. This perfect, minimalistic glass envelope is in the form of a cube, with each side made up of just three panes of three-ply laminated safety glass with dimensions of 10.30 x 3.30m.

Apple retail store New York, USA

Architect Bohlin Cywinski Jackson Architects, 2011



2 The structural glazing of the façade reflects a new level of technology. Because these are insulating glass panels measuring 14.5 x 2.8m.

3 The front façade is 13m high. But the special attraction of the store front is the integral entrance door, which opens over the full height and a width of 12m.

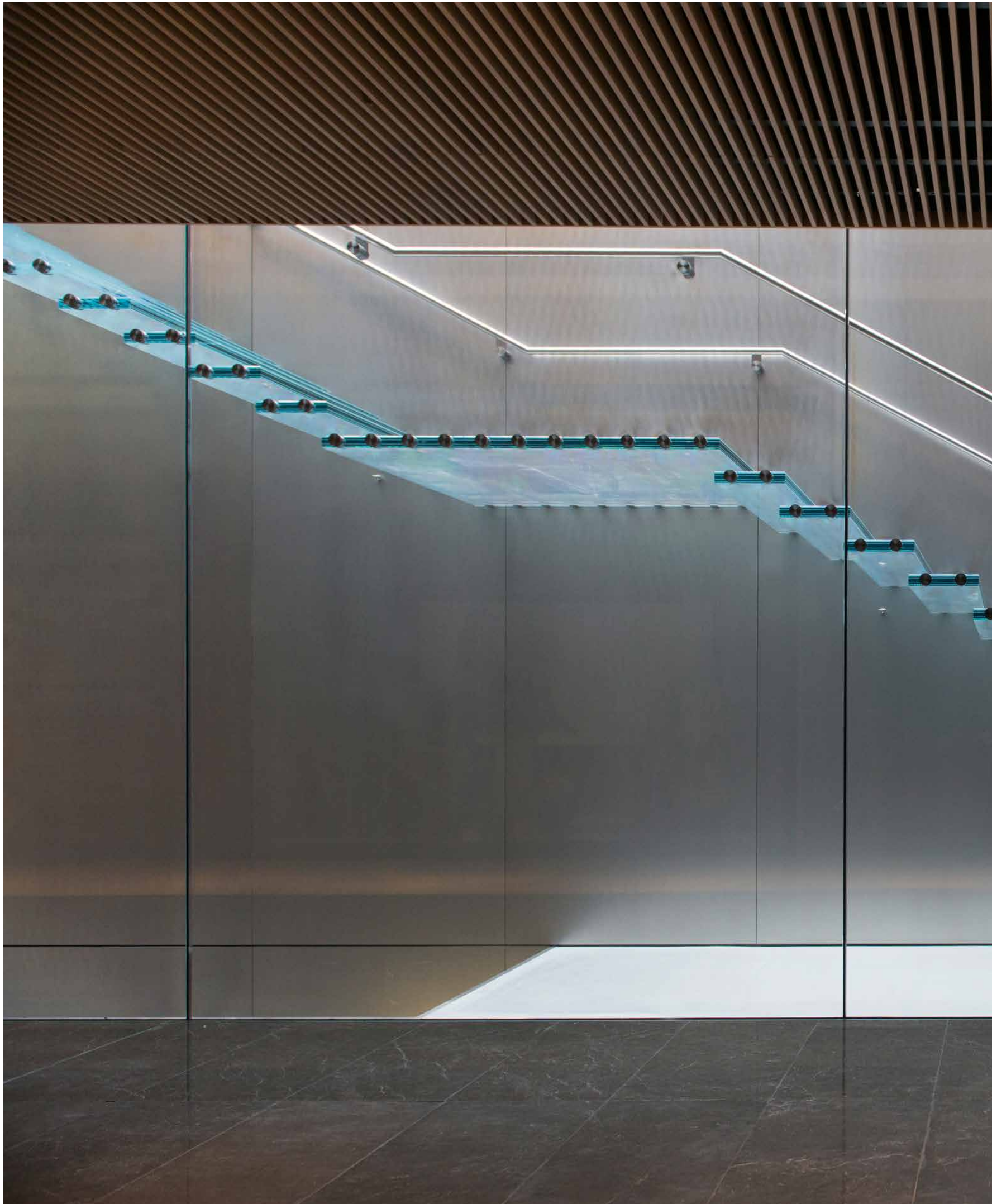
Apple retail store Singapore

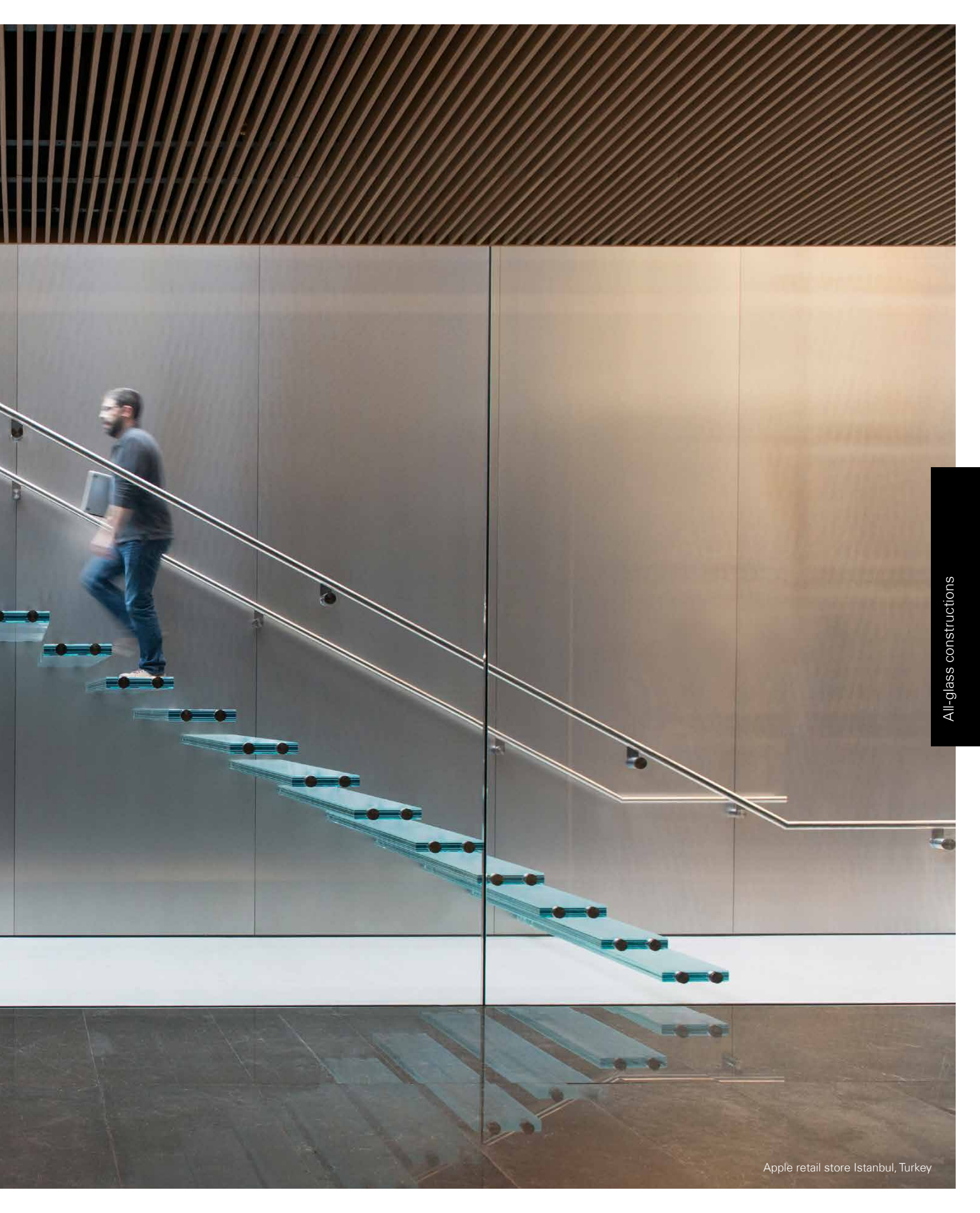
Architect Foster + Partners, 2017

Apple retail store San Francisco, USA

Architect Foster + Partners, 2016





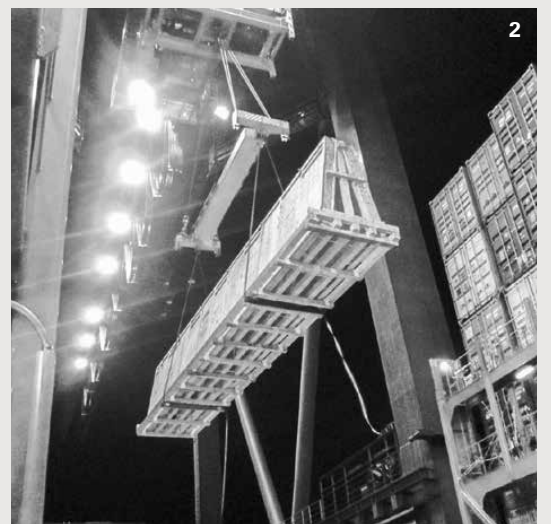


All-glass constructions



PERFECTION FROM ENGINEERING TO LOGISTICS

seele gives glass a leading role in façades and interior architecture. Using shear-resistant interlayers, the glass can carry heavy loads and therefore opens up entirely new opportunities for roofs, façades, balustrades, stairs and bridges of glass. Structural glazing designs are fascinating on a small scale, but are equally impressive on a large scale with unique pane formats. This results in exciting design options for residential buildings as well. The loadbearing capacity of glass is based on intelligent design and high production quality. seele has been developing its expertise continually for many years. To create pioneering façade solutions, seele brings together innovative players from all areas of design and engineering plus logistics and construction.



MAXIMUM CARE



3



4

1 Packaging and loading a 15m long glass fin for a project in Dubai.

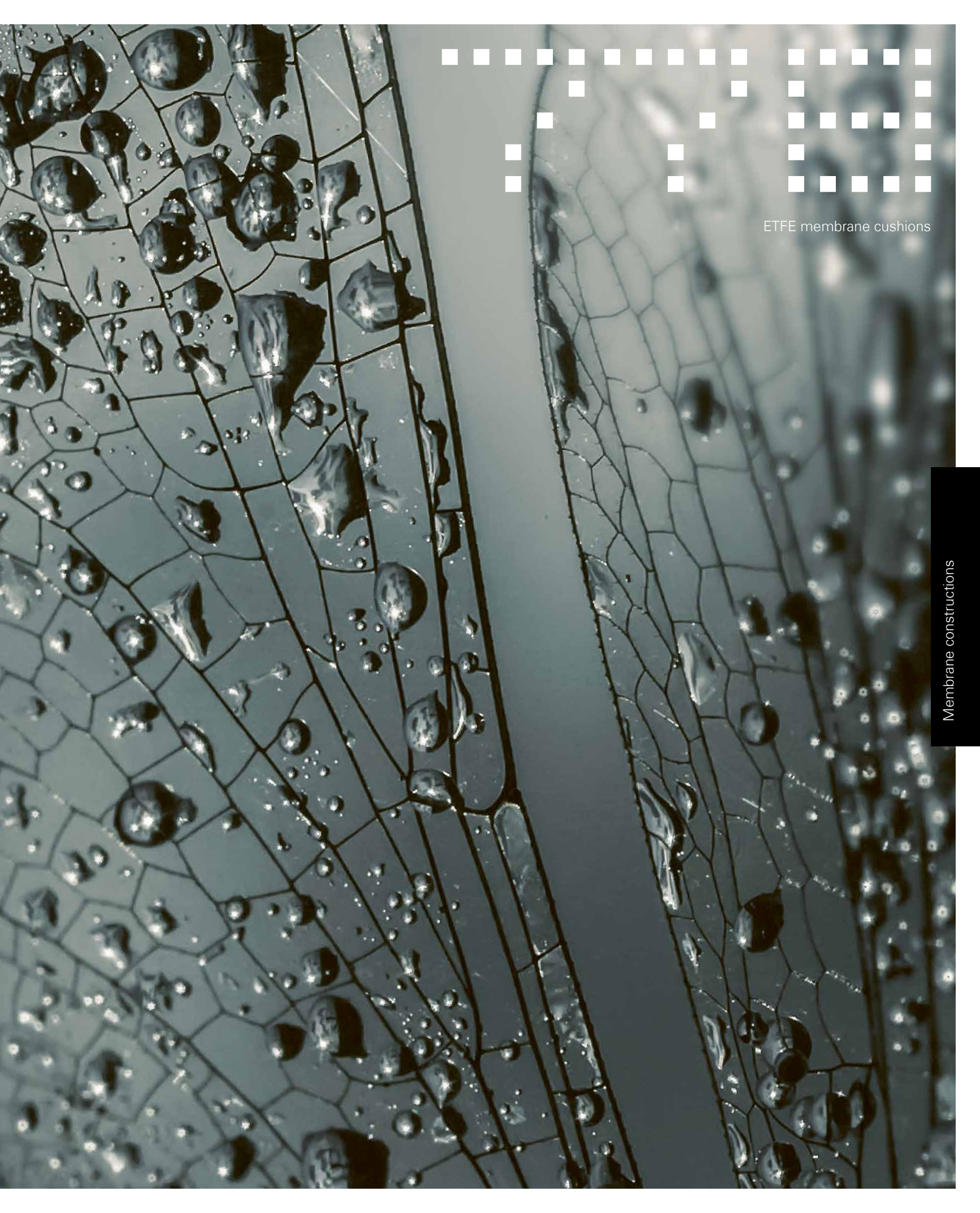
2 The large-format glass panes for seele façades are sent by sea to building sites all over the world. Transport of the pane is recorded exactly and fully by means of supervised shipping and measurements of sensitivity to impact.

3/4 A total of 333 glass fins and 333 glass fronts with pane lengths of up to 16m form this partitioned façade. The ICONSIAM project in Bangkok demanded maximum concentration during assembly. Even the vacuum lifter was specially designed for this project and enabled extremely accurate adjustment while mounting the panes.

There are many bionic principles to discover in the world of flora and fauna. Those principles have long since been used in architecture, too. But it was not until the arrival of advanced materials and innovative design and production methods that ways were found to use membranes to the full extent of their capacities in façades. Using air pressure, partial printing and intricate supporting structures, seele turns high-strength, multi-layer materials into multifunctional designs with impressive loadbearing capacity and aesthetics.

**nature knows about intelligent membranes.
we know how to build façades from them.**

Canary Wharf Crossrail Station, London, United Kingdom



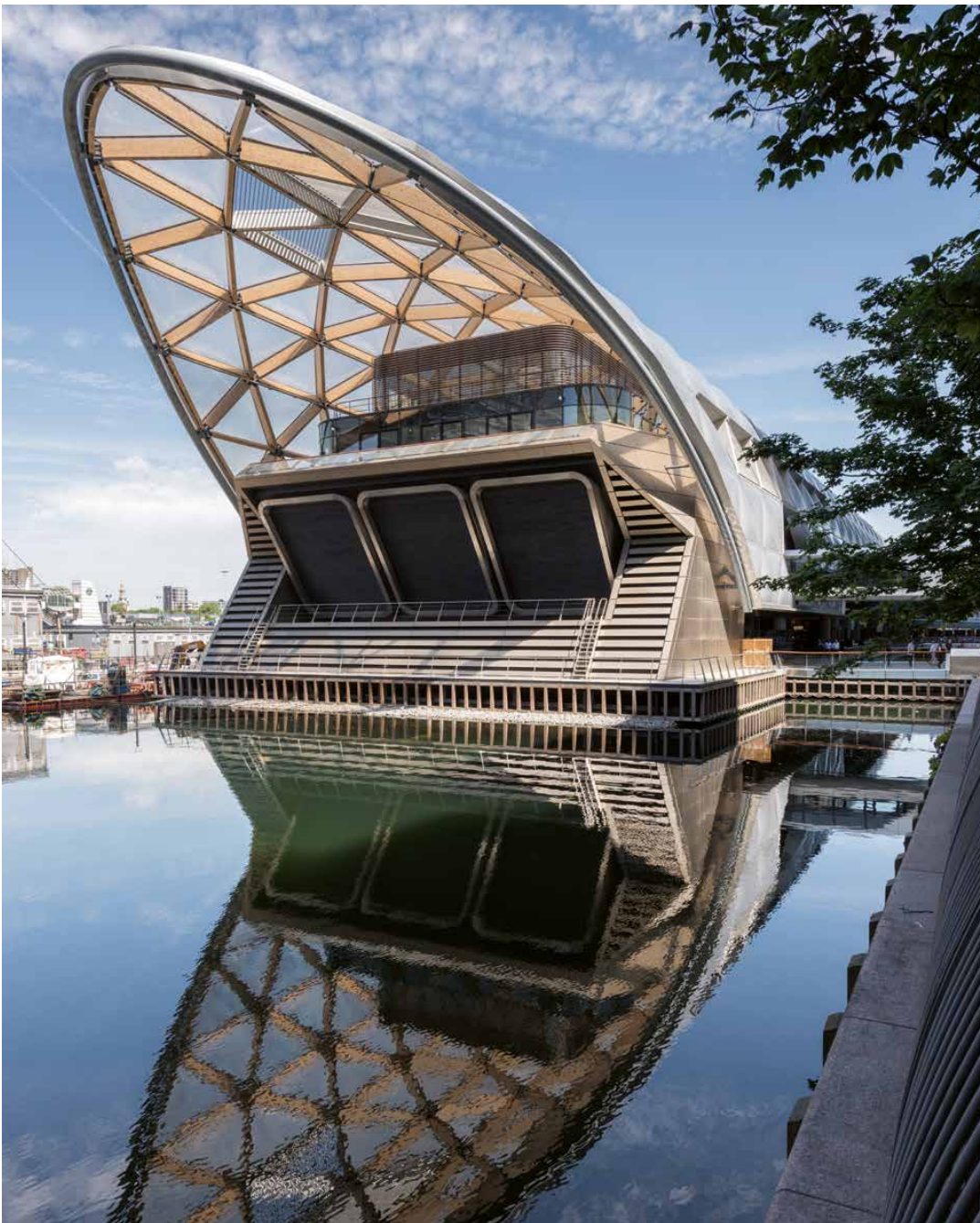
ETFE membrane cushions





Canary Wharf Crossrail Station,
London, United Kingdom

Architect Foster + Partners, 2015



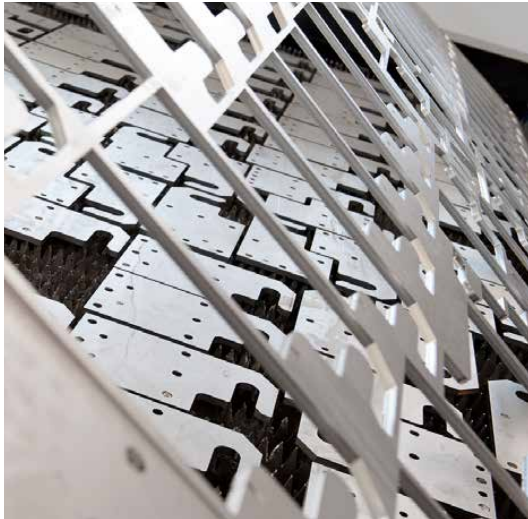
Canary Wharf Crossrail Station is an almost 300m long railway station in London's Docklands. Guaranteed to attract attention in this project the spectacular 10,000sqm roof is made up of 778 triangular ETFE membrane cushions surrounding a barrel-like grid structure of curved laminated timber. The particular challenge here was matching the cushions exactly to the timber structure; the double-curvature of some timber members resulted in many different triangular forms. seele developed an elegant solution for this. The structural and geometrical connections between the timber and aluminium substructure are guaranteed by an innovative common node system. The nodes also serve to fix the ETFE cushions.

1 A total of 564 steel nodes and an aluminium framework join the membrane cushions to the diagonal timber members – a true innovation in terms of engineering and fabrication.

2 The 10,000sqm roof is made up of 778 long-span ETFE membrane cushions in double curvature. The complex form, fabrication and erection take into account all the influencing factors such as temperature and time.



SOLUTIONS TO COMPLEX TASKS



creation of a unique design. designing a façade is a challenge. turning that design into uncompromising reality calls for a partner who is fully familiar with the whole range of options and can mix further innovative solutions into those options. that's exactly where our dedication counts. our role is to find solutions that take your ideas even further. we are not just planners and designers. we are also experts in fabricating, building and finishing your projects.



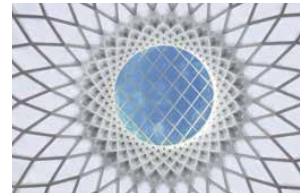
Central Library, Seattle



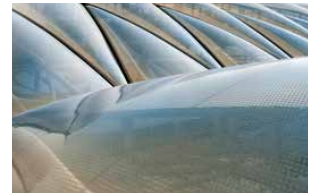
Mansueto Library, Chicago



Museum of Arts & Design, New York



Victoria Gate Arcades, Leeds



Lyon Confluence

seattle

Central Library

san francisco

Apple retail store
Union Square

cupertino

Apple Park

los angeles

Dior flagship store

calgary

Brookfield Place

toronto

TEC Bridge

ottawa

West Block
Rehabilitation project

chicago

Mansueto Library

dallas

Winspear Opera House

fort worth

Kimbell Art Museum

st. louis

Museum of Westward
Expansion & visitor centre

washington d.c.

United States Institute
of Peace

new york city

Burberry flagship store
The New York Times Building
Museum of Arts & Design
Apple retail store
5th Avenue
Lincoln Center
Private residence
St. Patrick's Cathedral
Moynihan Station

boston

Apple retail store
Boylston Street
MFA – Museum of Fine Arts

miami

Pérez Art Museum

rio de janeiro

Carioca Wave

london

Unilever Headquarters London
Westfield London
Apple retail store
Covent Garden
55 Baker Street
201 Bishopsgate and
Broadgate Tower
Aquatics Centre
5 Broadgate
7 More London Riverside
BBC Cyclorama
Canary Wharf
Crossrail Station
King's Cross
Olympic Stadium
Cutty Sark
Conservation project
25 Churchill Place
New Tate Modern
60 Holborn Viaduct
Principal Place Commercial
Brook Green
Hendon Quadrangle
Tottenham Court Road Station
Heathrow Airport
Centre Point
Bloomberg
Liverpool Street Station

leeds

Trinity Shopping Centre
Victoria Gate Arcades

watford

intu Watford

oxford

Westgate

leicester

John Lewis department store

southampton

WestQuay Watermark

edinburgh

Royal Bank of Scotland

dublin

Elm Park

nantes

Atlantis Shopping Centre

bordeaux

Château Margaux

paris

Hotel Wagram
Les Halles
Apple retail store
Carrousel du Louvre

lyon

Lyon Confluence
Shopping & leisure complex

Baku, Barcelona, Belfast, Bonn, Cairo, Cardiff, Chemnitz, Coburg, Copenhagen, Darmstadt, Dresden, Düsseldorf, Fröttmaning, Füssen, Garmisch-Partenkirchen, Glasgow, Guangzhou, Gütersloh, Heidelberg, Houston, Ingolstadt, Kiel, Kehl,



Strasbourg railway station



Väven Arts Centre, Umeå



Maximilianmuseum, Augsburg



Butterfly House, Sharjah



Bird's Nest Olympic Stadium, Beijing

neydens

Vitam Parc

mt-saint-martin

Auchan Pôle Europe
Shopping centre

strasbourg

Strasbourg railway station
Glazed concourse

luxembourg

European Investment Bank
Maison du Savoir

aigle

Velodrome

davos

Hotel & Resort
InterContinental Davos

umeå

Väven Arts Centre

bremen

University of Bremen
Entrance hall

hanover

Exhibition grounds
Entrance

hamburg

Apple retail store
Jungfernstieg

berlin

Berlin Brandenburg
International Airport
Hamburger Bahnhof
Museum für Gegenwart
Federal Printing Office

leipzig

Trade fair

cologne

Cologne/Bonn Airport

frankfurt

European Central Bank
Airport gate A-West
German National Library

koblenz

Forum Mittelrhein
Shopping centre

augsburg

Maximilianmuseum

munich

Siemens headquarters

vienna

Air traffic control tower

budapest

Aria Hotel

istanbul

Apple retail store
Zorlu Centre

abu dhabi

Sowwah Square

dubai

Viceroy Glass Cube
Jewel of the Creek

dhahran

King Abdulaziz Center
for World Culture

sharjah

Butterfly House

bangkok

ICONSIAM
Mahanakhon

beijing

Apple retail store
Wangfujing

Bird's Nest
Olympic Stadium

tokyo

Fendi store

nagoya

Apple retail store

singapore

Apple retail store
Knightsbridge

shanghai

Grand Theatre Shanghai

hong kong

Apple retail store
Canton Road
Chek Lap Kok
Hong Kong Airport

sydney

Apple retail store
George Street

melbourne

Chadstone Shopping Centre

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