Eckersley O'Callaghan

Engineers

# Practice Profile

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# Practice Profile

Eckersley O'Callaghan is an award-winning engineering design practice.

Since forming in 2004, we have grown to 120 strong, with offices in London, Manchester, New York, San Francisco, Los Angeles, Paris, Hong Kong, Shanghai, and Sydney. We work on a range of extraordinary building projects in the UK and across the world, from structures in timber, steel and concrete, through facades and bespoke glass structures to specialist marine design.

We have established an international reputation for our creative, yet rigorous, approach to engineering structures. Our engagement with architecture and industry underpins our pioneering use of materials to realise projects of exceptional quality, efficiency, and elegance.

We are well known for collaborating with Apple on all of their flagship projects around the world. Our innovative use of glass and carbon fibre reinforced polymers, as well as sensitive adaptations of historic buildings, have become signature features of the brand.

**Awards:**

**IStructE Award for Sustainability 2019**

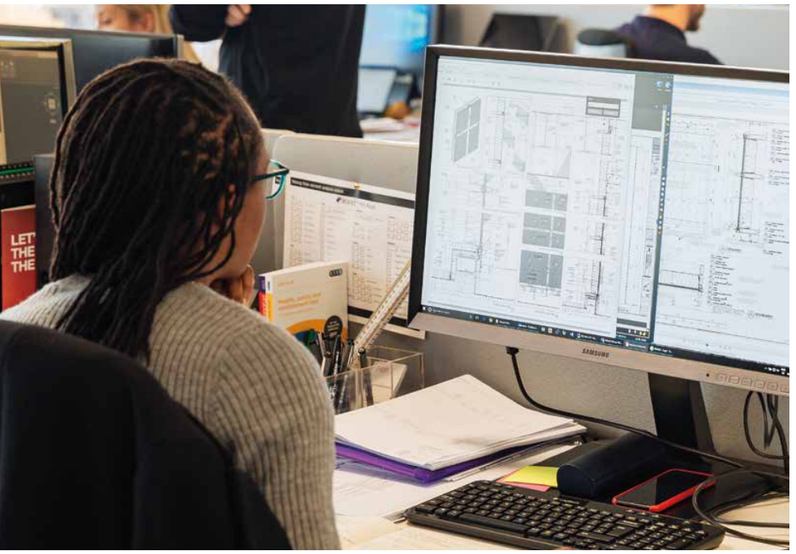
**Construction Consultancy of the Year, Construction News Awards 2019**

**Queen's Award for Enterprise 2018: International Trade**

**Engineering Consultant of the Year, Building Awards 2016**

**Construction Consultancy of the Year, Construction News Awards 2015**

**IStructE Supreme Award for Structural Engineering Excellence 2014**



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**10**
offices worldwide

**145**
project and company awards

**67%**
of work from repeat clients

Our expertise spans a broad range of services specialising in the following areas:

- Structural and Civil Engineering
- Facade Engineering
- Glass Engineering

Our commitment to technical excellence, innovation through R&D, and application of the latest digital tools places us at the forefront of the industry.

An extensive experience of projects in many different parts of the world means that we are adept at dealing with International Codes and Building Regulations, and with diverse local and cultural requirements.

Our services are engaged in a variety of ways, whether that's through the end-user client, as a sub-consultant to an architect or by the contractor responsible for constructing a project.

Our involvement may be to provide creative conceptual design, more detailed work for bidding and tender, or for full input through the construction of a project.

The practice has broad experience in the following sectors:

- Residential
- Retail
- Commercial
- Education
- Culture
- Leisure
- Infrastructure
- Marine

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**"Hawkins\Brown has worked with Eckersley O'Callaghan on a number of award winning projects. They frequently challenge preconceived structural conceptions, consistently deliver solutions that exceed expectations and are always a delight to work with"**

**Adam Cossey**
Partner | Civic, Community and Culture Lead
Hawkins Brown

01
Design review meeting

02
Site visit to Coal Drops Yard,
London

03
Company trip to Lake District

04
City of London Freemen's School Swimming Pool,
Ashtead, UK

# Sustainability

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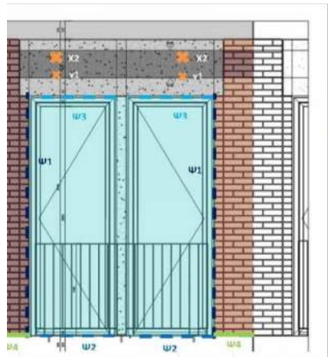
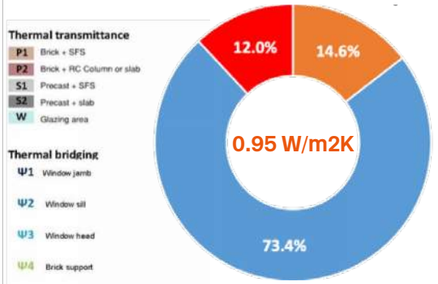
**100%**
renewable energy operated building

**50%**
less embodied carbon in construction

**180m**
tall hybrid timber building - tallest in the world



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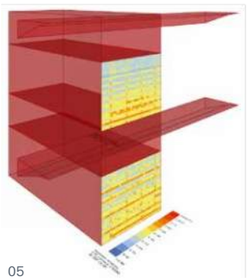

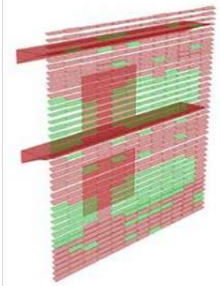

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## At Eckersley O'Callaghan we are committed to tackling the Climate Emergency and promoting low-carbon building design.

01
Atlassian, the tallest hybrid timber building

02
Atlassian facade will include solar panels to contribute to the buildings 100% renewable energy target

03
Overall U-value calculation of Monmouth House facade systems including thermal bridges

04
Monmouth House visualisation

05
Solar analysis of American Medical Centre's shading system to evaluate incident radiation on a glazed facade

06
Ecotone, the worlds first fully biomimetic project

07
White Eagle Lodge, London

Sustainable thinking informs all our projects, beginning at the earliest conceptual stages and continuing right the way through to completion. As an organisation, we recognise that urgent behavioural changes are needed to combat climate change and the impact it is already having on the planet.

A commitment to reducing the industry's environmental impact is embedded at every level of our business, from individual engineers, to specialist design and research groups, and across all of our global practices. We were proud first-day signatories of UK Structural Engineers Declare a Climate & Biodiversity Emergency, pledging to make significant efforts in reducing the industry's environmental impact.

Eckersley O'Callaghan has set up a Sustainability Research Group, which continually evaluates our approach and identifies strategies that will have the greatest effect in reducing our climate impact. This builds on our existing ethos of seeking out innovation at every possible opportunity. Our team is passionate about discovering new tools, new methods and new efficiencies that can help tackle the Climate Emergency.

Our carbon trackers, which incorporate industry-validated data, allow our clients and partners to make informed decisions about their projects, identifying carbon-cutting possibilities at the earliest opportunity, whether that's through retrofitting existing buildings, specifying more sustainable building materials like engineered timber, or incorporating high tech solutions like dynamic glass.

Our research projects with academic institutions like Politecnico di Torino and TU Delft mean we are directly involved in the development of the very latest sustainable technologies, while our close collaboration with trusted industry partners, including architects, contractors, fabricators and installers, ensures the sustainability measures we devise are practical, economical and buildable.

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**~50kg/m²**
of carbon dioxide when compared to the alternative load bearing masonry and steel-framed options

# Global Expertise

Through our network of 10 offices, we support a range of building projects around the world.

Since our first project – Apple's first European flagship store on Regent Street, London, in 2004 – our portfolio has grown to include other signature retail stores, private homes, significant commercial developments, cultural centres and transformations of institutional buildings.

Our technical expertise and international outlook have taken us to many regions around the world. Developing our understanding and experience of local working practices has proven to be instrumental in delivering successful projects for our clients.

**120**
experts employed

**28**
nationalities working in our offices

**32**
countries with live projects

**Projects**

**Offices**
London
Manchester
Paris
New York
Los Angeles
San Francisco
Hong Kong
Shanghai
Sydney
Delhi


Apple Union Square, San Francisco


Williamsburg Hotel, New York


International Spy Museum, Washington DC

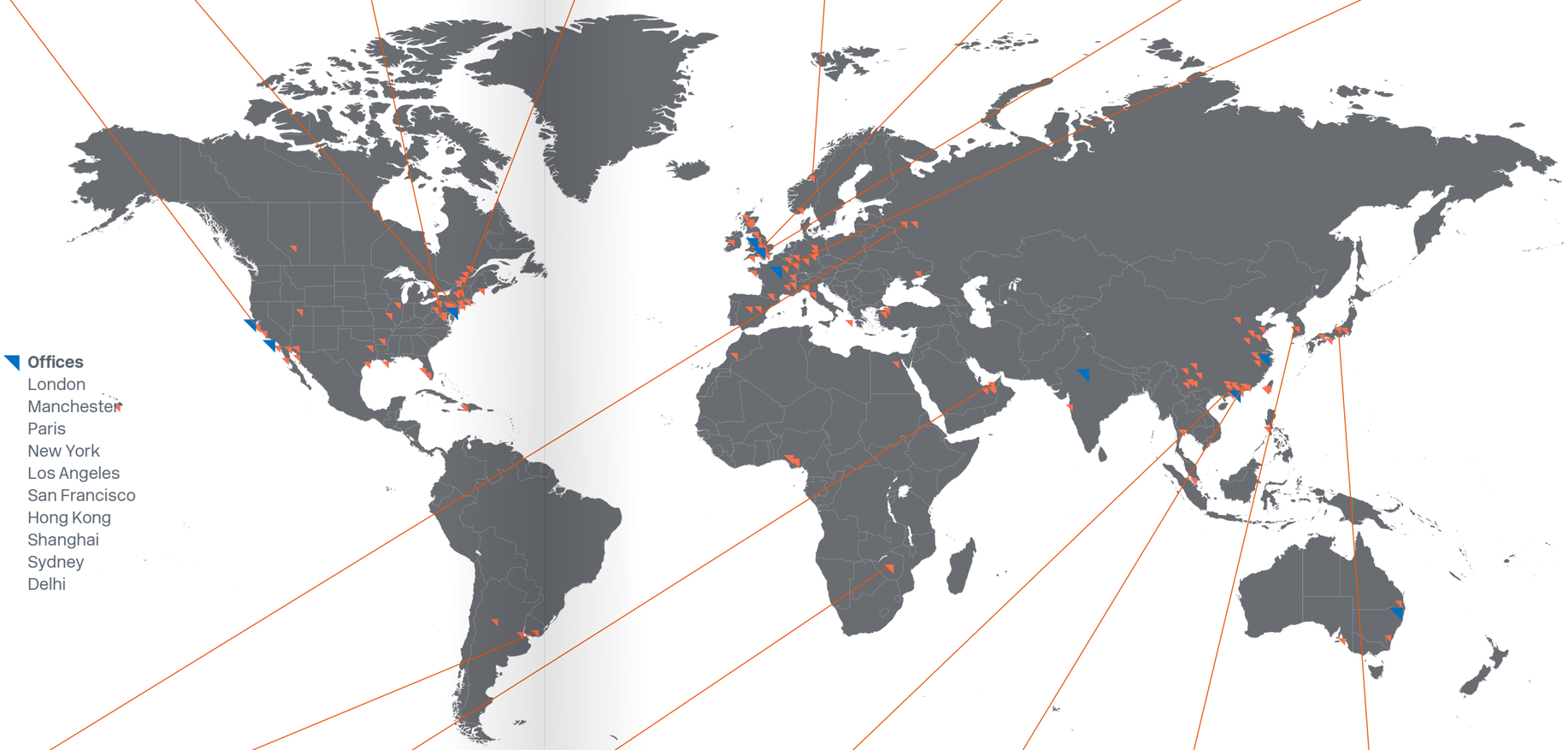

Novartis Institute for Biomedical Research, Massachusetts


Syling House, Norway


H B Allen Centre, Keble College, Oxford


Google Kings Cross London


FRAC, Île-de-France




Sberbank, Moscow


Trafigura, Uruguay


Apple Dubai Mall, United Arab Emirates


Gota Dam Residence, East Africa


Repulse Bay, Hong Kong


Shum Yip Towers, Shenzhen


Lightwalk Seoul


Apple Omotesando, Tokyo

# Awards

**IStructE Award for Construction Innovation 2021 –** Apple Marina Bay Sands

**IStructE Award for Structural Transformation 2021 –** Ashworth Centre and Library Extension - Lincoln's Inn Fields

**RIBA National Award 2021** - Zayed Centre for Research into Rare Disease in Children

**AJ Retrofit Awards 2021, Listed Building £10m and over** - Honourable Society of Lincoln's Inn Fields

**USA Property Awards, Best Architecture Single Residence USA 2020** - Tuscaloosa

**British Homes Awards, Small House of the Year 2020** – Island Rest

**British Homes Awards, Large House of the Year 2020** – Folding House

**AIA New York's 2020 Design Awards - Architecture Merit 2020** - Manhattan West

**AEI Excellence Award in Architectural Engineering Integration 2020** - Manhattan West

**AIA Architecture Award 2020** – Floral Court

**American Architecture Award 2020** – Apple Carnegie Library

**IStructE Award for Sustainability 2019** – La Reference

**Concrete Society Award 2019** – Sevenoaks School STC

**World Special Prize Exterior Award, Shops & Stores Category 2019** – Apple Piazza Liberty

**World Prix Versailles Award, Shopping Malls category 2019** – Coals Drop Yard

**Construction Consultancy of the Year, Construction News Awards 2019**

**Civic Trust Award 2019** - White Lion House

**RIBA South Award 2019** - Beecroft Building

**RIBA South Building of the Year Award 2019** – Beecroft Building

**RIBA South East Award 2019** – Sevenoaks STC

**RIBA South East Client of the Year Award 2019** – Sevenoaks STC

**RIBA London Award 2019** – Alleyn's School Lower | South London Gallery | Coals Drops Yard

**Queen's Award for Enterprise: International Trade 2018**

**IStructE Award for Structural Artistry** - Steve Jobs Theater 2018

**RIBA National Award 2018** - Freemen's School Swimming Pool

**Structural Timber Awards, Education Project of the Year 2018** – Freemen's School Swimming Pool

**RIBA South East Sustainability Award 2018** - Freemen's School Swimming Pool

**RIBA South Award 2018** - Hubert Perrodo Building, St Peter's College | Canoe Lake Tennis Pavilion | The Queen's College New Library

**RIBA South Conservation Award 2018** - The Queen's College New Library

**RIBA London Award 2018** - 70 Wilson Street

**Oxford Preservation Trust Awards' New Building 2018** - The Queen's College New Library

**WAN Award, Regional Winner EMEA 2018** – Hubert Perrodo Building, St Peter's College

**Engineering Consultant of the Year 2016, Building Awards**

**RIBA National Award 2016** - Investcorp Building

**WAF Awards, Higher Education and Research Building 2016** – The Investcorp Building

**RIBA North West 2016** – Library Walk

**Engineering Consultancy of the Year 2015, Construction News Awards**

**RIBA National Award 2015** – Levring House

**RIBA London Regional Award 2015** – Levring House

**Oxford Preservation Trust Awards' New Building 2015** – Investcorp Building

**IStructE Supreme Award for Structural Engineering Excellence 2014 - Apple Zorlu**

**British Glass Industry, Innovation Award 2014** – Eckersley O'Callaghan

**AIA SF Merit Award 2014** – Apple Stanford Mall

**WAN House of the Year Award 2013** – Gota Dam Residence

**New London Awards, House of the Year 2013** – Archway Studios

**Queen's Award for Enterprise: Innovation 2011**

**Design Award, Tri-States Design Conference 2011** – Apple Covent Garden

**AIA SF, Merit Award 2011** – Apple IFC Shanghai

**IDSA Design of the Decade GOLD, Biggest Contribution to Brand Growth 2011** – Apple Retail Stores

**Honour Award for Excellence in Architecture, AIA San Francisco 2011** – Apple Upper West Side

**RIBA Award 2011** – Mill House

**Merit Award, New York Construction/McGraw-Hill 2011** – Apple Upper West Side

**Honor Award, AIA California Council 2011** – Apple Boylston Street

**RIBA Award 2009** – Stowe School

**Honour Award for Design Excellence, Boston Society of Architects/AIA 2009** – Apple Boylston Street, Boston



# Clients

Almacantar
Alexander McQueen
Apple
Argent
Ballymore
Birley Group
Boodle & Dunthorne
British Film Institute (BFI)
Bulgari
Canary Wharf Group
Capco
Caprice Holdings Ltd
Corporation of London
Cote Restaurants
Derwent
Dukelease
Edmonton Public Library
Freemen's School
Frieze Art Fair
H&M
Habitat
Harrods
Imperial War Museum
Keble College, Oxford
Knauf
Knight Dragon
L&Q
Land Securities
Lendlease
London Legacy Development Corporation
London School of Economics
Muse Developments
Northumberland County Council
Notting Hill Housing
Novartis
PIXAR
Royal Institute of British Architects (RIBA)
Sevenoaks School
San Francisco Museum of Modern Art (SF MOMA)
Stanhope
St Antony's College, Oxford
St George
St James School
Science Museum
Shepherd Construction
Starck
Stowe School
Swire Properties
Tishman Speyer
University of Oxford
V&A Museum
Westfield
Willmott Dixon
Yoo Capital

# Collaborators

AHMM
Allies and Morrison
Amanda Levete Architects
Architecture PLB
Art & Build Architect
Assael Architecture
Atomik Architecture
Ayre Chamberlain Gaunt
BGS Architects
BIG Architects
Bond Bryan Architects
Carl Turner Architects
Casson Mann
Design Engine
Duggan Morris Architects
Eric Parry Architects
FJMT
Foster + Partners
Gardiner and Theobold
Gensler
Gilbert Ash
Gollifer Langston Architects
Grimshaw Architects
Haverstock
Hawkins\Brown
Heatherwick Studio
Herzog & de Meuron
Hopkins Architects
James Gorst Architects
Kier Group
KPF
MICA Architects
MUMA
O'Donnell + Tuomey
Rafael Viñoly Architects
Rogers Stirk Harbour + Partners
SimpsonHaugh Architects
Snohetta
SO-IL Architects
Squire and Partners
Stanton Williams
Studio E Architect
Studio Seilern Architects
TDO Architecture
Tim Ronalds Architects
UN Studio
Walters & Cohen
Wates
Waugh Thisleton
WilkinsonEyre Architects
Willmott Dixon
Woods Bagot
Zaha Hadid Architects
ZMMA

# Services

**“In my experience, I have not come across another consultant engineer that can consistently deliver both the creative and technical integration of thought to yield the outcomes we have achieved.”**

**BJ Siegel**
Senior Design Director
Apple

Apple Westlake
Huangzhou, China

# Structural & Civil Engineering

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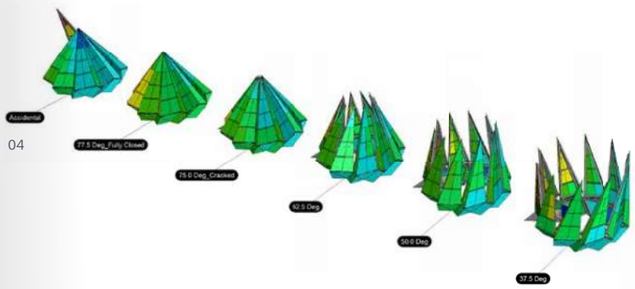

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**“The outcome of the building would not be anywhere near as successfull, without the creative engineering input from Toby and his team.”**

**Darren Bray**
Technical Director
PAD Studio

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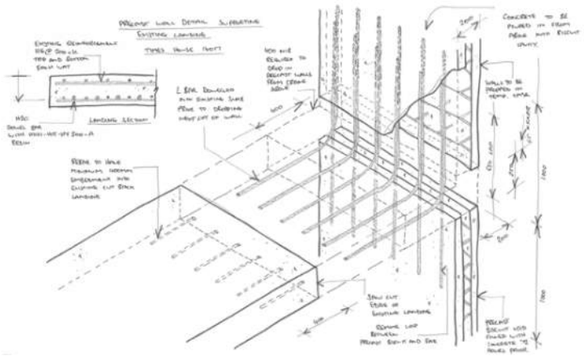

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## We approach our work by fully interrogating all structural options to identify the most efficient, economic and elegant solutions.

01
Perrodo Building, Oxford

02
El Gouna, Egypt

03
Irène Joliot Curie building, Paris

04
BIM model of Wooldbeding Gardens greenhouse

05
Visit to Weihag Factory with Hawkins\ Bto inspect CLT structural material

06
Tropicalia, Côte d'Opale

07
Vitsoe Headquarters, Warwickshire

08
Precast wall supporting existing landing

Our work covers all structural materials, traditional and non-conventional. We aim to provide clear options which address the parameters defined by the project and its architecture. Our team is a blend of both analytical and creative engineers, who can make pragmatic decisions as well as design refined details, enjoying a collaborative approach within a design team and beyond with the contractors.

We place high priority on our responsibility to help tackle the Climate Emergency and are committed to promoting low-carbon building design where we have developed a toolkit to monitor the carbon footprint of our design proposals. We have been at the forefront of modern timber design, utilising mass timber, Cross Laminated Timber (CLT) and highly engineered timber in a number of our built projects.

Projects might be in the context of new-build, or refurbishment and restoration of traditional and historic buildings. The extent of our involvement may be to provide creative conceptual design, more detailed work for bidding and tender, or for full input through construction of a project.

We engage with digital design tools and BIM, which are embedded in our workflow. These processes allow us to uncover efficiencies, improve decision making, fully integrate our structures, and enhance delivery. We believe that digital design tools are key to successfully realising intelligent engineering solutions for complex challenges.

**Toby Ronalds**
**Director of Structural Engineering**
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# Facade Engineering

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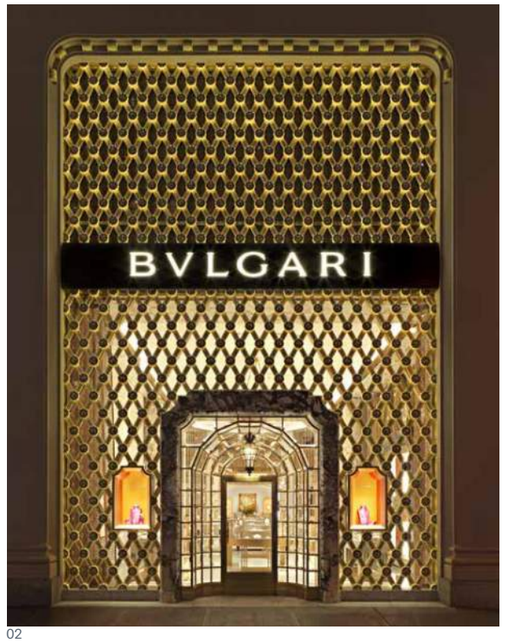


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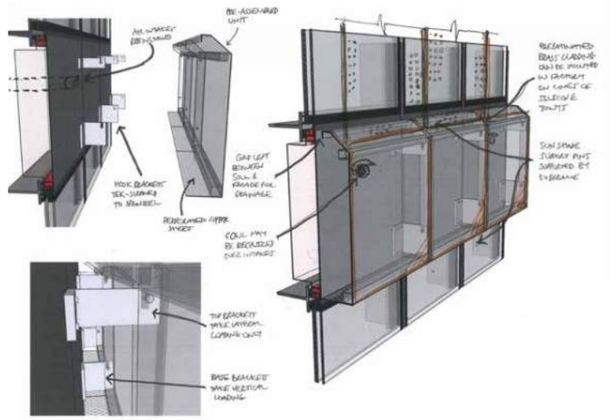

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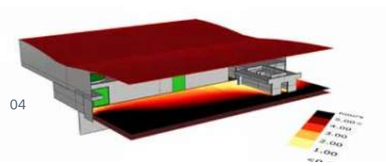

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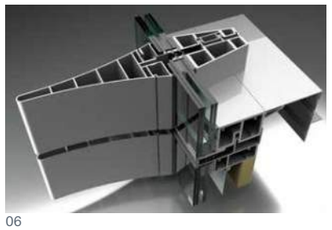

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**We are working with EOC under a framework agreement, and as a trusted expert partner, they give us the confidence to provide best value solutions, while mitigating risk.**

**Mark Tant**
Managing Director
Wates Group

## Eckersley O'Callaghan includes one of the largest facade engineering groups in the UK, offering a full-service approach to facade design.

01
Sberbank,
Moscow

02
Bulgari 5th Avenue,
New York

03
70 Wilson Street
facade design

04
Building solar analysis

05
SF MOMA,
San Francisco

06
Render of facade
mullion

07
The Williamsburg
Hotel, New York

08
Coal Drops Yard,
London

09
The Waterman,
London

As building envelope design becomes more complex due to increasingly stringent energy requirements and material and technological advances, Facade Engineers have assumed a central role in architectural and engineering design teams in recent years.

We offer a full service approach to facades in all material types, using standard or bespoke systems, delivered either as performance-specified or fully detailed design. In addition to structural design and system detailing, we have the tools to assess the facade energy performance and ensure compliance with efficiency targets. Additionally, we maintain a close relationship with industry suppliers to ensure we are aware of the latest technology in materials, manufacture and performance.

As a practice, we take a very sustainable approach to design and at the core of this is the re-use of existing buildings. We therefore offer a comprehensive service of existing facade condition survey and reporting, in which condition and remedial works required can be identified and specified. Beyond that, entirely new facade systems can be designed and specified that can be compatible with the existing building structure, giving the building a new sustainable lease of life.

The breadth of our expertise across the discipline includes detailed environmental analysis. This supports our ability to engineer building envelopes that fully, and efficiently, meet all performance criteria.

**Damian Rogan**
**Director of Facade Engineering**
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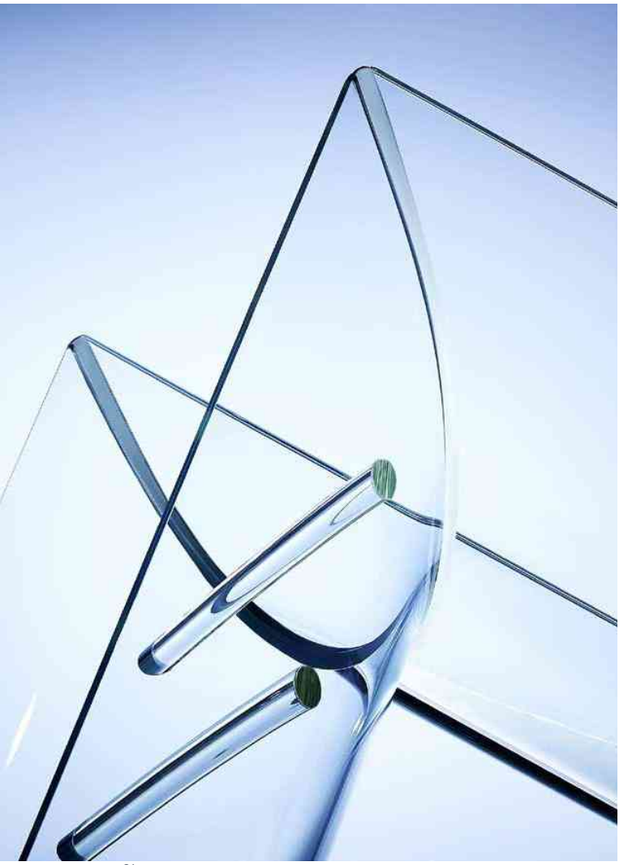
# Glass Engineering



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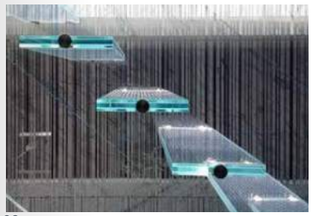

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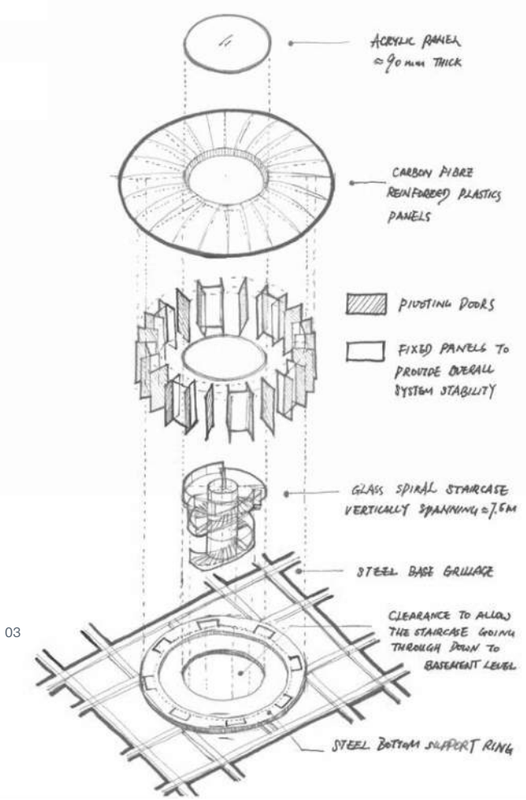


03

## For over a decade, Eckersley O'Callaghan has driven the development of glass as a structural material.

01
Vidre Glass Slide 9m

02
Apple Kunming, Kunming, China

03
Exploded sketch of Apple Kunming

04
MY Venus Superyacht

05
Apple Upper West Side, New York

06
Glass staircase of Repulse Bay residence, Hong Kong

07
Iona Skydome

Our rigorous testing, disciplined analysis and creative application of glass, has been responsible for a rapid evolution in the scale and form of glass structures worldwide.

We have increased our technical capabilities to meet the ambitions of our clients, minimising joints, increasing strength and enlarging panels. Our ongoing pursuit for greater transparency has revolutionised glass manufacture and resulted in the world's largest glass panels and the world's largest structures supported solely by glass.

With glass, rigorous structural analysis and flawless detailing are more critical than in other structures. We draw on our experience in the research and development of materials and analytical software applications to help us.

We are particularly adept at getting new structural glass designs through the complex building department requirements of different cities. We have been invited to sit on many of the standards committees around the world formed to develop more universal codes of practice governing the design of structural glass.

In 2010, our work in glass was recognised with a Queen's Award for Enterprise: Innovation by HM Queen Elizabeth II.

**Ian Langham**
**Director of Glass Engineering**
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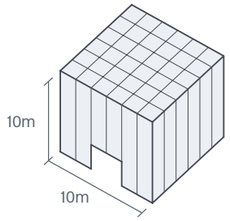
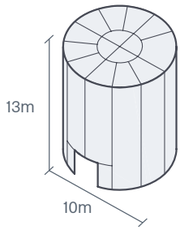
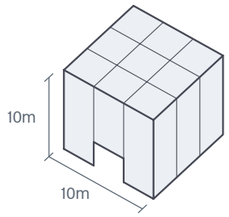


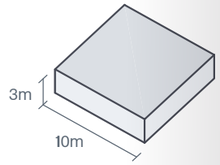

**2006**
Apple 5th Avenue
New York
164 glass units
250 primary fixings




**2009**
Apple Pudong
Shanghai
Worlds first 13m tall
curved panels



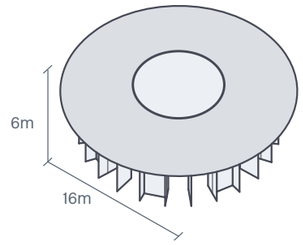

**2011**
Apple 5th Avenue
New York
28 glass units
40 primary fittings



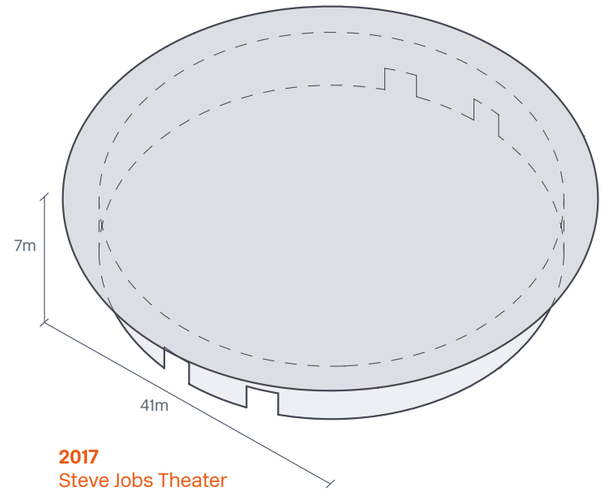

**2014**
Apple Zorlu
Istanbul
4 glass units
0 primary fittings

Our ongoing pursuit for greater transparency has helped to contribute towards revolutions in glass manufacturing which resulted in the world's largest glass panels and structures supported solely by glass.



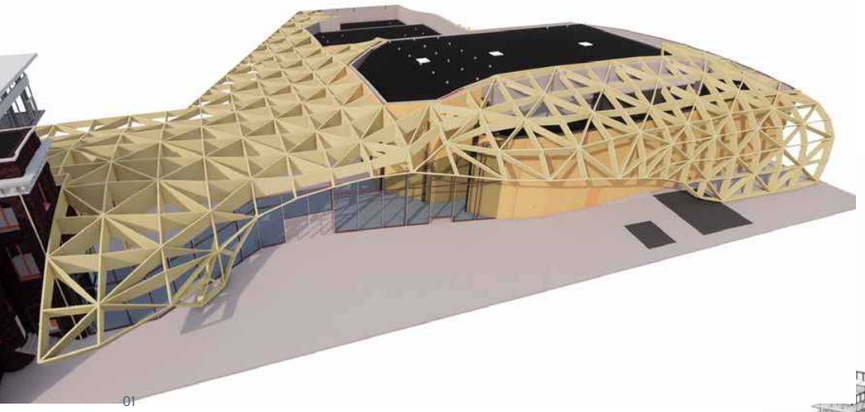



**2016**
Apple Kunming
China
Worlds first use
of glass doors with
bespoke interlayer
fixings




**2017**
Steve Jobs Theater
California
Worlds largest
carbon fibre roof and
structure supported
solely by glass

# Building Information Modelling



01

02

We see BIM as inherently integrated into the way we work, playing a vital role in any building project that we engineer.

Our expertise in BIM enhances design quality through better collaboration, communication and coordination. It enables us to visualise, explore and integrate all the requirements of the project team to produce efficient engineering solutions for the full life cycle of the building.  The BIM model is developed as an information-rich asset for the client.

We were early adopters of the BIM approach. We achieve BIM Level 2 as standard - the exchange of CAD models between consultants for combining into a federated model which can be checked and coordinated. We can tailor our service to meet the specific requirements of each project.

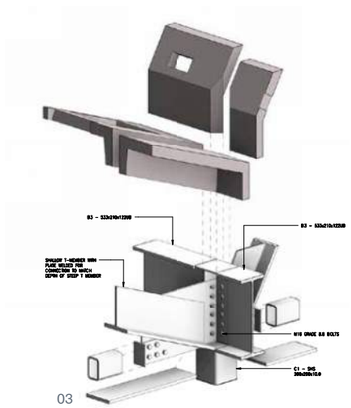
Our design process incorporates analysis software which are seamlessly conversant with Revit. Working in conjunction with our bespoke digital design tools, we bring value in our workflow to uncover efficiencies and better solutions. We aim to distil potential complexity into simpler, more rational solutions with buildability, cost and programme benefits.

We use Autodesk Revit as one of our primary tools for delivering BIM. We integrate and exchange smoothly with Revit as well as numerous other packages as required by each project.

01
Structural model
of Trinum, Lomme,
France

02
Bridge Street development,
Leeds, UK

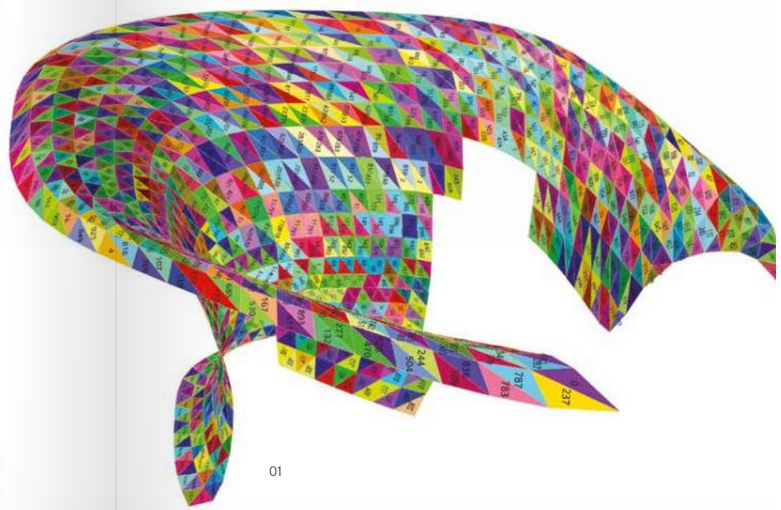
03
Detailed model of
roof connection



03



# Digital Design



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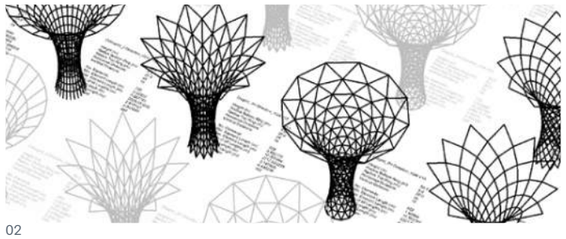

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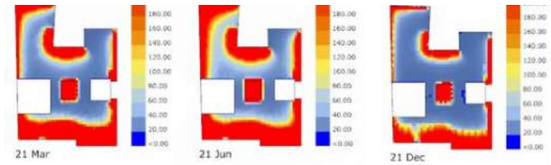


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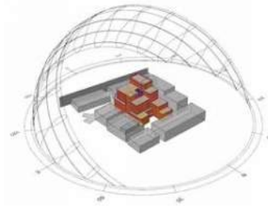


Our leading digital design skills mean that we can work faster and leaner giving more time to explore options and refine the design.

By focusing on R&D, we have taken each and every aspect of a building's design and embedded digital design at its heart, from the workflow between disciplines and stages, to rationalising geometry, to structural optimisation and environmental modelling. Each stage of a project can benefit from this approach.

**Parametric Workflow**
Parametric modelling and workflows at an early stage of the design process allows us to respond to design changes quickly, explore more options and move between geometric and analysis softwares seamlessly.

**Structural Optimisation**
Our digital design services encompass the world of structural optimisation, the holy grail of engineering design - the use of material, only where it is needed. Using our bespoke computational design tools, we find best fit beams and columns and cut embodied carbon. This saves weight and cost, improves environmental performance, user comfort and mitigates fabrication issues.

**Complex geometry manipulation and modelling**
Compromise of a design vision is unacceptable, but practical constraints often put a block on their development. Our deep level of understanding of geometry, combined with digital skills enables us to turn visions into buildable, cost and time efficient reality.

**Environmental Engineering**
We understand how to harness the best and mitigate the worst of the external environment's influence using bespoke scripting to rapidly analyse building and site specifics.

We can create facades that balance spilling natural daylight deep into buildings versus limiting excess heat loss or gain using complex calculations to identify the technological 'sweet-spot'.

01
Panel clustering
Clustering method to find common shapes out of 1501 unique glass panels

02
Parametric grid options exploring different structural steel column topologies

03
Solar analysis for an office building against WELL Gold criteria

# Projects

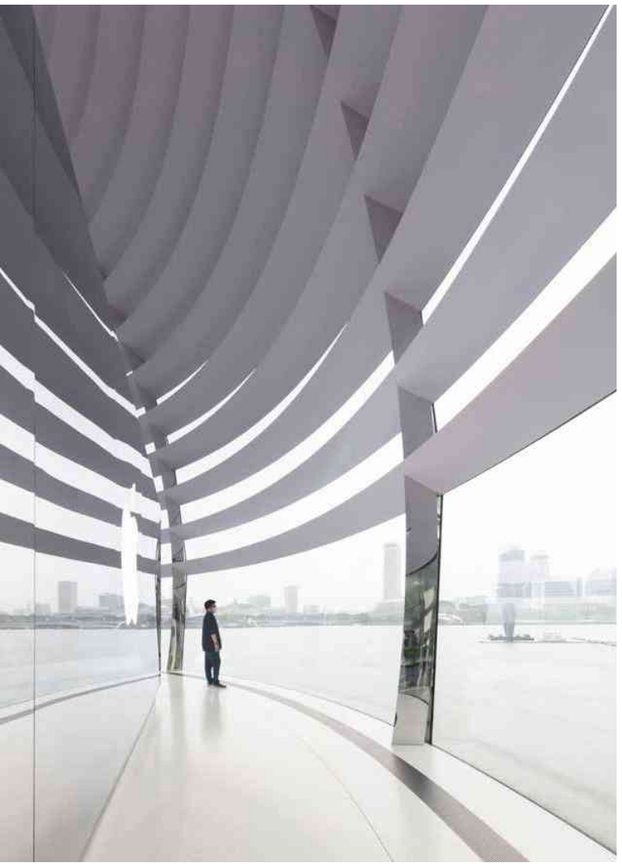
**“A highly professional firm which has provided creative but practical solutions on projects both large and small. Highly recommended”**

**Roger Boden**
Bursar, Keble College,
Oxford University

H B Allen Centre, Keble College,
Oxford, UK

# Commercial & Retail

# Apple Marina Bay Sands



01

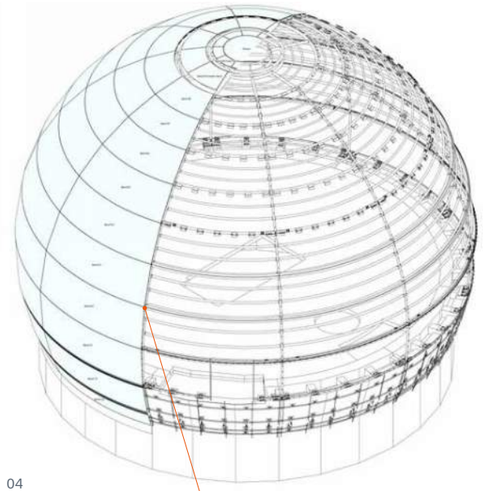
02

03

**17m**
tall structure giving extensive views across the bay

**114**
glass panels to create a first-of-its-kind, self-supporting structure

**10**
slender vertical mullions for structural framing



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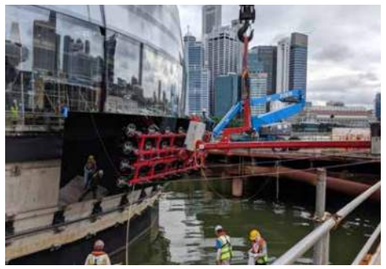

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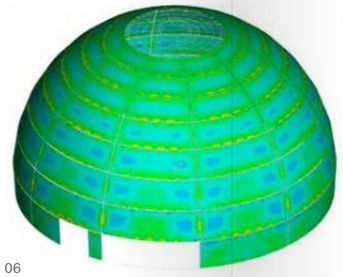

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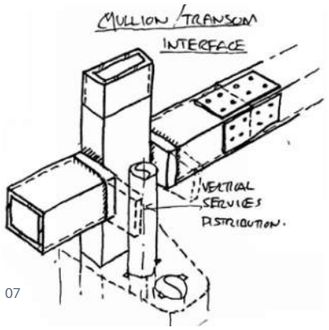


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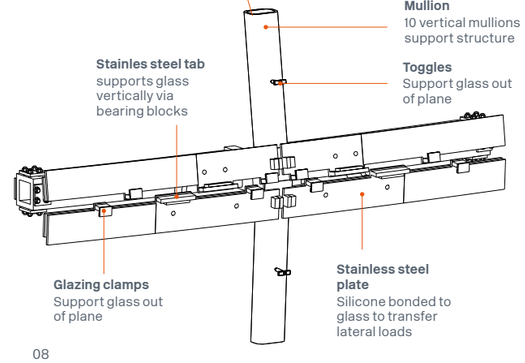



08

**Locations: Marina Bay Sands, Singapore**
**Client: Apple**
**Architects: Foster + Partners**
**Date: Completed 2020**
**Value: Undisclosed**
**Services: Structural | Glass Engineering**

01
Internal view, transom and mullion

02
Apple Marina Bay Sands

03
Internal retail space

04
3D structural model

05
Installation of 10m wide glass panel

06
Analysis of stresses on structure

07
Design development of mullion and transom connection

08
Connection detail of mullion and transom

Eckersley O'Callaghan carried out the structural and facade engineering for the first-ever Apple Store to sit directly on water. We also undertook a site supervisory role for this unique building which appears as a sphere that floats on Singapore's iridescent Marina Bay.

The sphere itself is a first-of-its-kind, glazed dome structure that is fully self-supported and comprises 114 panels of glass with only 10 narrow vertical mullions for structural support.

This stunning, complex and yet deceivingly simple-looking dome structure creates a wide open and column free space inside, and in a feat not done before on this scale anywhere in the world, we designed the individual glass panels to brace and stiffen the structure rather than use additional diagonal steel bracing or large moment connections at the joints.

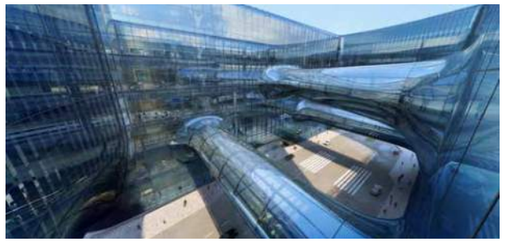
We also maximised the size of the insulated glass panels to limit the number of joints, hiding them only where there is structure, and increasing the overall transparency of the building (the largest of these panels measures 10m wide x 3m tall). To give the dome its geometry and to meet the required environmental performance, the panels were designed to be conical in shape with each individual panel 'warm' or lamination bent into shape. Again, this was the first time that this type of bending had ever been used at this scale before.

A central circular domed panel of glass, the Oculus, crowns the top of the dome. In the event of a fire, the adjacent glass panels rise up to release smoke inside the building. In addition, circumferential baffles around the dome act as glare protection and acoustic attenuation panels. We provided the full superstructure design from concept through to supervision on site and completion.

Careful consideration of the combination of multiple coatings and constantly changing frit patterns was key to achieving the strict environmental performance criteria.

The dome's super slender steel structure was designed to retain its lightweight appearance. The ability to contain the various services (including lighting and sprinkler system) within the cladding and still meet the overall architectural vision was vital to creating Apple's trademark minimalist look inside.

# Sberbank Technopark



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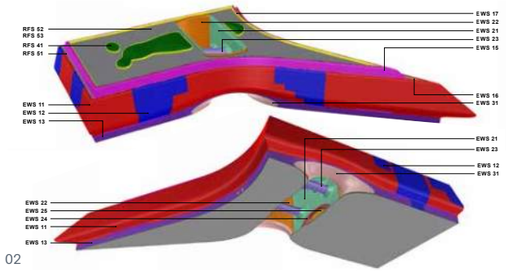



02

**Location: Skolkovo, Moscow**
**Client: Sberbank**
**Architect: Zaha Hadid Architects**
**Date: Completion due 2021**
**Value: Undisclosed**
**Services Provided: Facade Engineering**

Eckersley O'Callaghan is engineering the envelope of the new Sberbank Technopark at the Skolkovo Innovation Centre in Moscow. Sberbank is Russia's market leader for banking and financial services, used by over 70% of the country's population. The new building will provide 131,000 $m^2$ of office space for the 12,000 employees in Sberbank's marketing and IT departments.

We have developed 20 different types of glazed and solid facades, roofing systems, soffits and atrium skylights across the project. We have engineered the curtain wall facades as glazing systems utilising structural silicone joints. A unitised system is used across the majority of the envelope's complex geometry, while a stick system is used in the remaining areas. Primary steel structures support the facade elements.

Our design of secondary structures includes base-supported wind posts with spans varying from 7m to 45m in the Winter Garden areas, and a gridshell type system of interconnected beams spanning 80m by 30m in the main gate's soffit areas. We have also provided secondary systems for canyon facades, canyon bridges and skylights. Key primary structural movement joints have been provided for all the systems.

We have developed Digital Design tools in Grasshopper to analyse the complex glass geometry. These have determined the fabrication processes required to achieve the form of each panel and the thermal and visual performances. Maintaining visual consistency of glass panels across the entire envelope has been a key requirement.

01
Canyon bridges

02
Zoning of facade types



# The Featherstone Building

01

02

**Location: London, UK**
**Client: Derwent London**
**Architect: Morris + Company**
**Date: Completion due 2021**
**Value: £40m**
**Services Provided: Facade Engineering**

Located adjacent to Old Street Roundabout and Derwent's award-winning White Collar Factory, the Featherstone Building is an 11-storey, 12,000$m^2$ commercial office development on a sensitive site overlooking the historic Bunhill Fields. Materiality and texture are at the core of this project, with the rough concrete and irregularities of the brickwork in direct opposition with the contemporary glazed architecture typical in the City.

Hand-laid brickwork and sandblasted precast are revisited to accommodate large spans. Materials and finishes were chosen through careful and sensible sample selection and mock-ups. Traditional construction methods are tuned up to respond to the current design standards and commercial demands. An apt illustration of the project's ambitious design is the recessed reception area which features a big transfer structure with an exposed concrete soffit seemingly shooting past a six-metre double-height curtain wall glazed facade.

Our team carried out an extensive review of buildability options to understand how tradition and offsite construction methods could be employed and how these different strategies would inform the detailing.

Early collaboration with the design team has allowed us to find the optimal balance between NIA, thermal performance of the facade, and buildability.

01
Handlaid brick with full span structural precast beam option

02
Handlaid brick with precast rainscreen option

# Atlassian

01

02

03

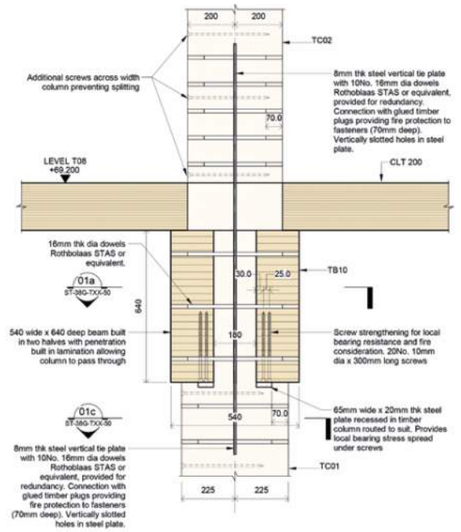


04

**180m**
world's tallest hybrid timber building

**100%**
renewable energy operated building

**50%**
less embodied carbon than traditional tall building construction

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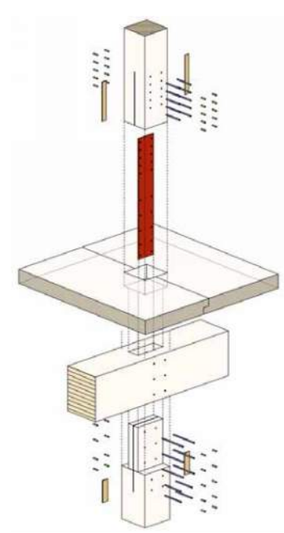


06

**Location: Sydney, Australia**
**Client: Atlassian**
**Architect: SHoP | BVN**
**Date: Completion due 2025**
**Value Undisclosed**
**Services Provided: Structural | Facade Engineering**

01
Visualisation of 40-storey high Atlassian HQ

02
Internal 'habitats' built with mass timber, having a significant impact on reducing the embodied carbon footprint.

03
Staggered gardens at the 'crown'

04
3D structural model of the tower, showing timber habitats and steel mega structure

05
Timber column connection detail inside office space exposed internally and designed for disassembly and re-use, ensuring a long term carbon sequestration

06
Exploded 3D view of glulam beam to column connection detail

We are providing the structural and facade design for the world's tallest hybrid timber building in Sydney, Australia. The new approximately 40-storey high building is being designed in conjunction with New York-based architect SHoP, who will work in partnership with Australian firm BVN and will provide a new headquarters for technology giant Atlassian.

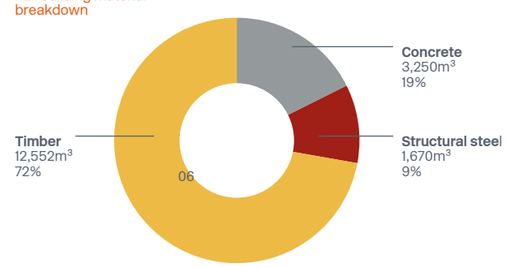
The groundbreaking design of timber, with a glass and steel facade will include a mix of outdoor and indoor spaces and will use an energy-efficient approach that features natural ventilation and large planted terraces giving access to nature. The building is leading edge in its application of Mass Timber Construction (MTC).

In line with Atlassian's commitment to operate on 100% renewable energy and reach net zero emissions by 2050, the project will target:

- 50% less embodied carbon in construction compared to a conventional tall building
- 50% less energy consumption compared with a new conventionally operated building and solar panels in the vertical facades, to generate green power on-site
- The building will operate on 100% renewable energy from day one and include solar panels built into the facade.
- Measuring at approximately 180m this will be the tallest commercial hybrid timber building in the world. The tower includes a steel exoskeleton that supports the mega floors between neighbourhoods .

The current design also incorporates an electricity-generating facade system with self-shade capabilities to reduce direct heat gain internally. Combined with the use of mass timber, the innovative facade enables the project to leverage Sydney's temperate climate to help reduce carbon emissions and generate on site energy.

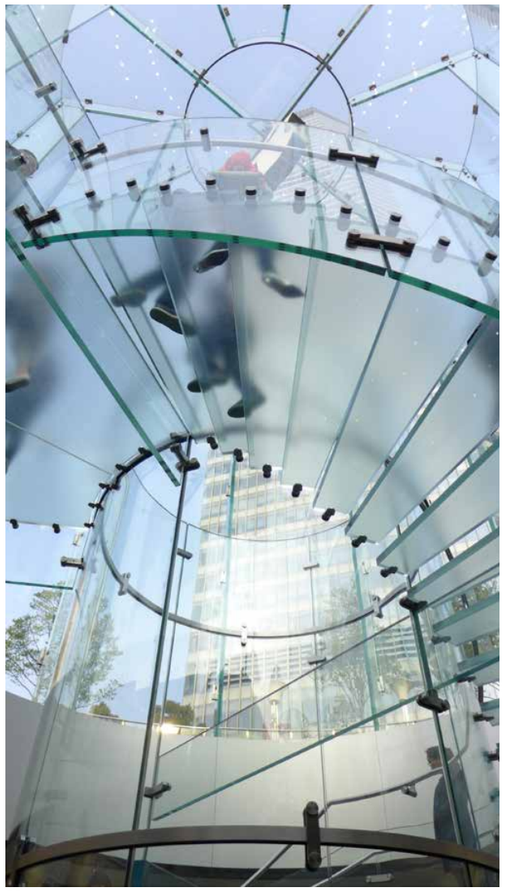
Full building material breakdown



# Apple

01

02



08

03

04

05

06

07

**Locations: Worldwide**
**Client: Apple**
**Architects: Bohlin Cywinski Jackson | Foster + Partners**
**Date: 2004-present**
**Value: £5m - £4bn**
**Services: Structural | Facade | Glass Engineering**

01
Apple Zorlu, Istanbul

02
Apple Park, California

03
Apple Upper West Side, New York

04
Steve Jobs Theater, California

05
Apple Piazza Liberty, Milan

06
Apple Regent Street, London

07
Apple Marunouchi, Japan

08
Apple Pudong, Shanghai

Eckersley O'Callaghan has engineered over 350 structures around the world for Apple, spanning a 17 year collaboration. This has resulted in a range of highly innovative projects, including pioneering developments in glass technology which have garnered international recognition through a number of prestigious awards.

Through our work on 350 retail stores, we have been listed on 20 patents with Apple. Predominantly, we offer specialist glass engineering services, however we also frequently act as design engineers for the whole building structure.

The Apple projects demonstrate our ability to push the boundaries of innovation in the design of glass structures and their supporting elements.

We have increased our technical capabilities to meet the ambitions of our client, minimising joints, increasing strength and enlarging panels. In 2006, the Apple 5th Avenue glass cube was constructed from 106 glass panels with 250 primary fittings. By 2014, the Apple Zorlu glass lantern required only four glass panels, with no primary fittings.

Our ongoing pursuit for greater transparency has revolutionised glass manufacture and resulted in the world's largest glass panels and the world's largest structures supported solely by glass.

**IStructE Structural Artistry Award 2018** - Steve Jobs Theater

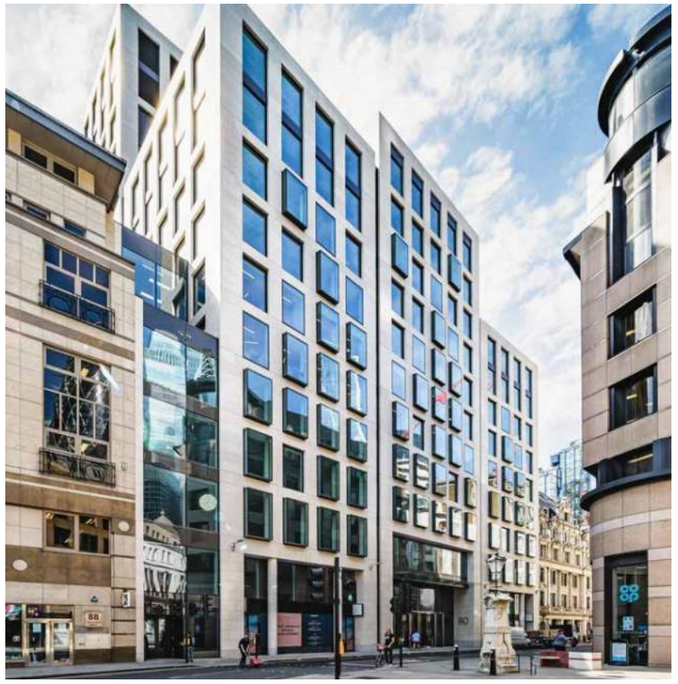
**IStructE Structural Artistry Award 2017**- Apple Kunming

**IStructE Supreme Award for Structural Engineering Excellence 2014** - Apple Zorlu

**Queen's Award for Enterprise 2010: Innovation**

**350+**
buildings engineered worldwide

# EightyFen



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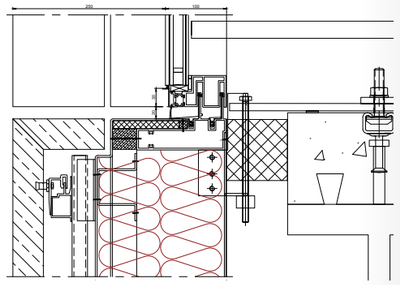


01

**Location: London, UK**
**Client: Exemplar**
**Architect: TP Bennett**
**Date: Completed 2021**
**Value: £200m**
**Services Provided: Facade Engineering**

**BREEAM Excellent**
**Wired Score Platinum**

Eckersley O'Callaghan was the facade consultant for this new commercial office building in the heart of the City of London, which provides over 22,000m$^2$ of workspace. The building is located on a constrained site and reaches 15 storeys in height, with a series of roof terraces at different levels. The structure has a 15m grid for maximum flexibility of use.

The facade is composed of natural limestone and has punched windows arranged in alternating bays as projecting, flush or recessed to animate its appearance. The distribution of projecting bays responds to internal daylight and solar gain requirements within the building, meaning recessed bays are more prevalent towards the top of the building.

The varied alignment of the glazing modules created technical challenges in achieving the required thermal performance and maintaining continuity of the weather line.

After exploring a number of potential construction methods, a unitised curtain wall approach was adopted to improve speed of construction and allow reliable off-site performance testing.

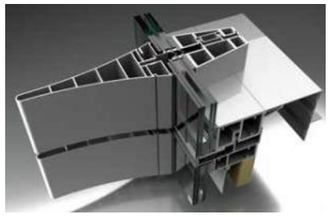
Along with the specialist contractor, we developed a unitised sequence and stone support details that allows the limestone to be set with a traditional monolithic appearance without a grid of aligned vertical joints.

01
Recessed window stack joint detail



# Two Taikoo Place

01



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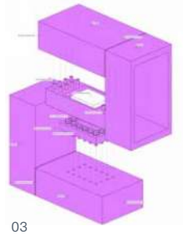


03

**Location: Hong Kong**
**Client: Swire Properties**
**Architect: Wong & Ouyang | NBBJ**
**Date: Completion due 2021**
**Value: Undisclosed**
**Services Provided: Facade | Glass Engineering**

**BEAM Plus (HK)**
**LEED Platinum**

Eckersley O'Callaghan provided facade and specialist glass engineering services for Swire Properties' iconic new addition to their Taikoo Place development which sets new standards in energy performance.

Across the 190m tall facade, we used the latest developments in glazing production to ensure high levels of light transmission, designed external shading fins to reduce solar gain and chose insulated glass units with high performance coatings. Together, these measures formed part of an energy efficiency strategy that enabled the project to achieve BEAM Plus (HK) and LEED Platinum certifications.

The facade was designed as a unitised system with 3m wide units offering uninterrupted views to Hong Kong Harbour. In addition, geometric optimisation studies of the conically curved corner panels were performed to reduce the number of unique panels by 60% and maximise the number of glass fabricator suppliers. This resulted in a cost reduction without affecting the architectural intent.

The building's base also features a 15m tall podium facade, realised in a frameless structural glazed system using integrated pre-tensioned stainless steel rods – a first of its kind in Asia.

01
Visualisation of 16m tall podium

02
Unitised curtain wall mullion

03
Unique podium facade slide bearing joint

# Vitsœ Headquarters

01

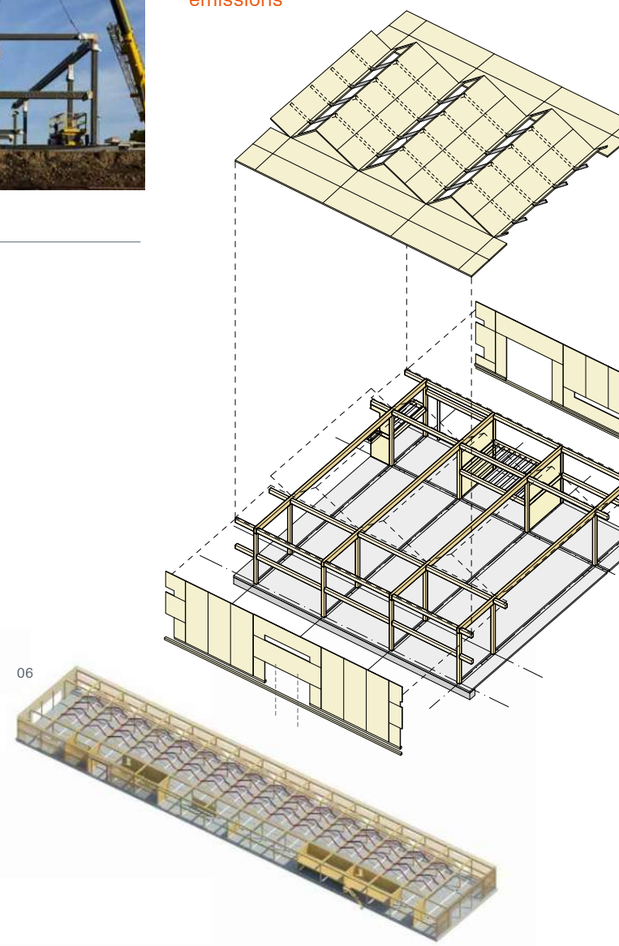
02

03

04

05

**-65kgCO$_2$e/m$^2$**
building
sequestered
carbon
emissions



06

**Location: Leamington Spa, UK**
**Client: Vitsœ**
**Architect: Waugh Thistleton Architects**
**Date: Completed 2017**
**Value: £5.5m**
**Services Provided: Structural Engineering**

01
Vitsoe Headquarters;
one of eighteen bays

02
Construction
of CLT building

03
Completed production
building

04
Exposed Sherpa
connection

05
Construction
of prefabricated parts
of CLT structure

06
3D exploded view
of single bay and
structural concept

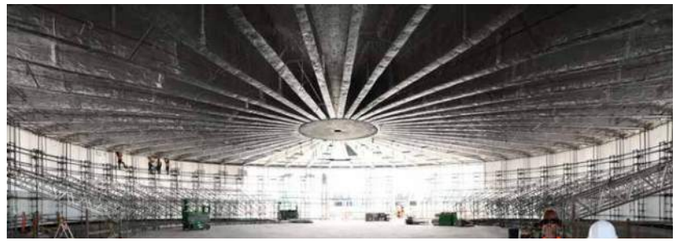
In 2017, British furniture manufacturer Vitsœ moved to a new headquarters and production building. The building was conceived as an extension of Vitsœ's system-thinking. Spanning 135 metres in length, 25 metres in width and six metres in height, the structure is engineered to be modular, flexible, adaptable, and self-explanatory, with innovative material use.

The building features a timber frame, comprised of hardwood, laminated veneered lumber (LVL) members and cross-laminated timber (CLT) walls for both the envelope and internal shear walls. It's the first building in the UK to be made almost entirely from a newly developed Beech LVL timber material. The LVL used on this project has twice the strength of typical glue-laminated timber beams.

Eckersley O'Callaghan provided the design of all timber frame elements from concept through to detailed design. To avoid piles and settlements of the ground floor slab, an innovative stabilisation technique was utilised to strengthen the made ground. As a result, only pad and strip footings were necessary to support the superstructure, which represented a significant saving in cost. It took just 23 days to erect 18 bays and resulted in a carbon negative building, saving 320 tonnes of carbon emitted into the atmosphere.

Our challenge was to design a building that could be constructed in the same spirit as Vitsoe's own products. This has been achieved with a flexible system building that can be easily altered, dismantled and replicated anywhere in the world.

# Steve Jobs Theater



**Location: California, USA**
**Client: Apple**
**Architect: Foster + Partners**
**Date: Completed 2017**
**Value: Undisclosed**
**Services Provided: Glass Engineering**

**SentryGlas Innovation Award for Engineering 2018**
**IStructE Structural Artistry Award 2018**

---

Over the last 15 years, Eckersley O'Callaghan's close relationship with Apple has been accompanied by a rapid evolution in structural glass technology, and the Steve Jobs Theater represents a culmination of these advances.

As a true technology pioneer, it is fitting that Apple's new landmark venue for product launches was designed using innovative technology, some of which has never been seen before on a structure of this scale.

For example, it is the largest structure in the world solely supported by glass, with an 80 tonnes roof supported by a 7m tall glass cylinder, made up of glass panels, each consisting of four layers of 12mm thick plies, which hold up the roof without any additional support.

We also designed the structural system so that the conduits, sprinkler pipes, data, audio and security systems in the roof could be accommodated in the 30mm joints between the glass panels.

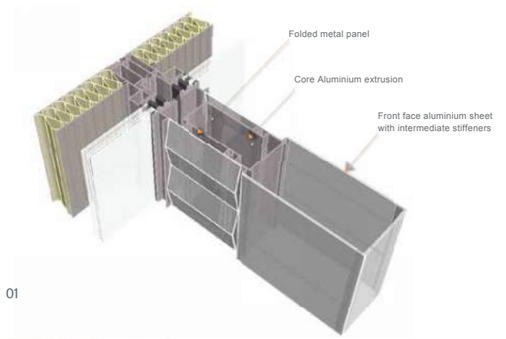
In addition, the structural criteria were also particularly challenging given the properties of glass with its inherent brittleness requiring detailed analysis to fully justify safe design – not to mention the fact that Cupertino is in a highly seismic zone.

Consequently, we employed several strategies to protect against earthquakes and transfer seismic energy, including curved glass panels fixed at their base with structural silicone into a steel channel. Steel plates were also engineered to deform before the glass breaks, safeguarding the integrity and robustness of the overall structure.

Working closely with Foster + Partners, we also engineered the design of the world's tallest free-standing glass elevator, which stands 12.8m tall and corkscrews on helical guides to facilitate an exit point 171 degrees rotation from entry.



# 14 Westfield Avenue




01

**Location: London, UK**
**Client: Westfield Europe Ltd**
**Architects: SimpsonHaugh & Partners**
**Date: Completed 2021**
**Value: Undisclosed**
**Services Provided: Facade Engineering**

**BREEAM Excellent**

---

14 Westfield Avenue is a new 800,000 square-foot commercial office development in Westfield's Stratford City estate.

Eckersley O'Callaghan engineered the facade of the building, which is formed of two blocks standing at 13 and 14 storeys tall. These blocks are wrapped in floor-to-ceiling glazing and over-clad with an external grid of shading fins.

We engineered the fins to be made from bronze-anodised aluminium in order to provide a substantial reduction in solar gain, allowing greater clarity in the glass and contributing to a BREEAM Excellent certification and a highly energy-efficient building.

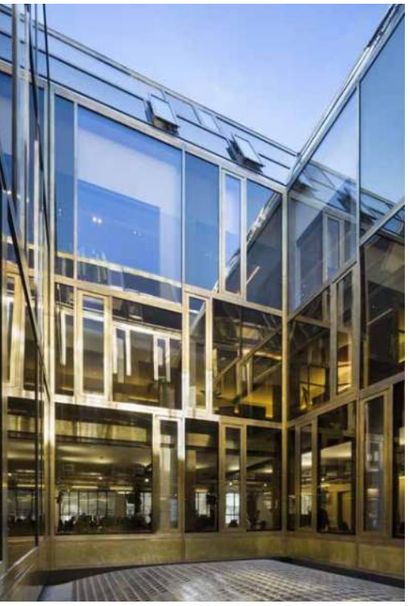
The building also features a roof garden enclosed in a glazed 'crown', a 7m-high glazed lobby, and a glazed roof over two central atriums.

We have worked closely with the architect and fabricators to develop a bespoke unitised curtain wall system for the external facades. The large scale of the external shading fins required extensive pre-engineering of the system and up-front design of the bespoke aluminium profiles.

01
Unitised system
with external fins

01

02



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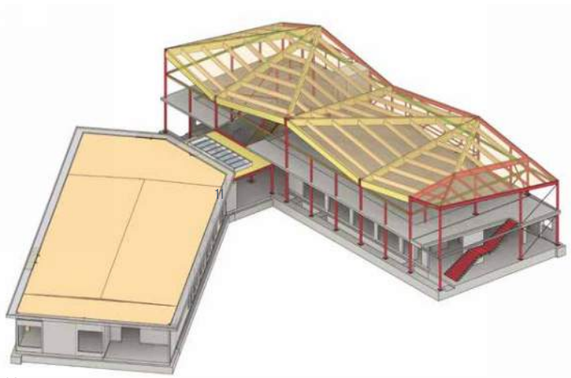


08

01
Shum Yip Towers,
Shenzen

02
111 Main Street,
Salt Lake City

03
Weill, Paris

04
Bulgari
Glasshouse,
Valenza

05
70 Wilson Street,
London

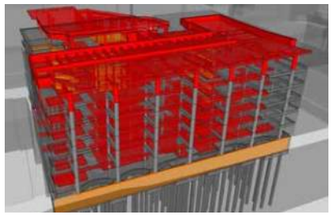
06
Goldman Sachs,
London

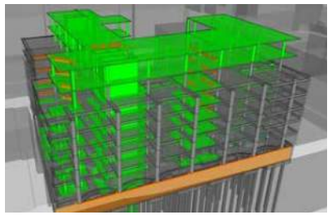
07
Google Kings
Cross,
London

08
Promega
Headquarters,
Southampton

# Residential

# Times House





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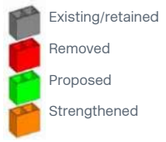



**Location: London, UK**
**Client: St George**
**Architect: Hawkins\Brown**
**Date: Completed 2018**
**Value: £13m**
**Services Provided: Structural Engineering**

The Times House project involved the conversion of the existing News International editorial building into residential flats as part of the larger St George London Docks Development, providing 70 new affordable homes to the borough.

The five-storey building required major structural alterations to its reinforced concrete frame to suit a new layout. We removed the Primary RC stability cores, including partial removal of adjacent floor slabs. New stair and service riser cores were introduced to take over the building's stability system. A new floor was added over the entire building footprint and existing floor plates were removed and re-instated in new configurations.

Floor slabs were extended and strengthened, while other redundant voids were infilled. Structural columns were removed and relocated with transfer structures installed to support the new floor configurations.

The removal of the building's primary RC stability system required our in-depth analysis and design of a temporary steel stability bracing system.

We were involved from the project outset, providing our expertise in renovations and major structural works to the design and construction teams, ensuring all decisions made on construction techniques were well-informed.

It was important the construction team understood the breadth of alterations proposed. To support this, we created visualisation models to demonstrate areas to be demolished, strengthened or added in.

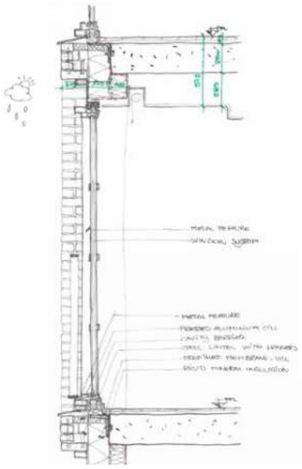
01
Temporary stability systems

02
Existing structural layout to be removed

03
New structural layout proposed



# Arundel Street



01

02

**Location: Manchester, UK**
**Client: Logik Developments**
**Architect: SimpsonHaugh & Partners**
**Date: Completion due 2021**
**Value: £80m**
**Services Provided: Structural | Facade Engineering**

Eckersley O'Callaghan is providing structural and facade engineering services for this residential scheme in Manchester, which is the first project in the city for Andrew Flintoff's Logik Developments. Situated where the Mancunian Way passes through Castlefield, the scheme includes a 36-storey tower, with 159 apartments, and a mid-rise, mixed-use building that features 223 square metres of commercial space and another 215 flats.

The existing Dot Motorcycle building, which dates from the 1900s, will see its red brick facade retained, while the building's interior is transformed into new commercial and residential space. There will also be a roof garden for residents.

The tower features a geometry of shifted blocks, each four storeys in height. The primary structure remains vertical, with the shifts achieved via cantilevered winter garden structures formed as part of the glazed envelope. The building has a high proportion of glazing, and the winter garden design has been carefully developed with the architect and MEP engineer to avoid the potential for overheating.

We have helped achieve early cost certainty for the project by developing a detailed Building Information Model, which has been used during the costing exercise. We have also undertaken an extensive value engineering exercise for the foundations and substructure, considering different systems, buildability and programme.

Our Facades team took a similar approach to the design, looking at various precast and unitised systems for the different facade types on each building, with the aim of achieving a fast on-site programme.

01
Facade detail

02
3D model of structure showing optimised column sizes

# Private Homes

01

02

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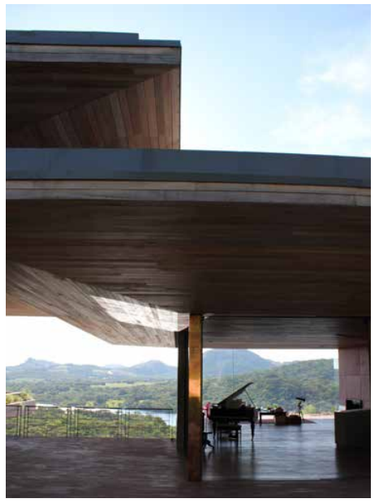

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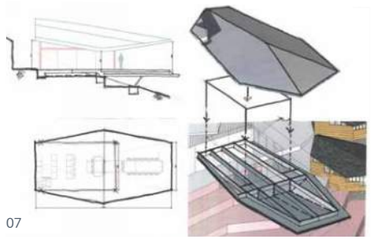

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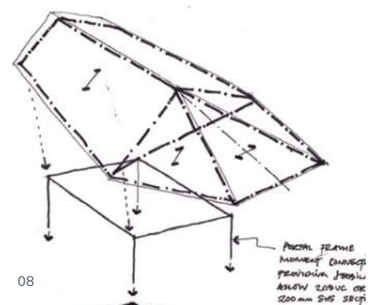

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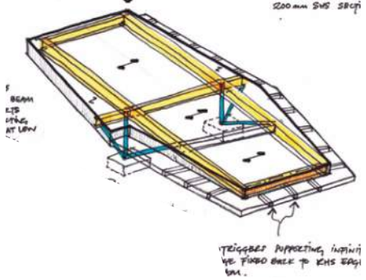

## Since 2004, Eckersley O'Callaghan has developed a diverse portfolio of private housing projects.

01
Drag & Drop House,
London

02
The Crow's Nest,
Dorset

03
Hamptons Residence,
New York

04
Syling House,
Norway

05
Holly Barn,
Norfolk

06
Gota Dam,
East Africa

07
Reserva Alcuzcuz,
Spain, architectural
concept model

08
Reserva Alcuzcuz,
Spain, practicalities
and buildability

We have established close relationships with architects, designers and contractors throughout the UK and beyond. We employ a collaborative approach to ensure the design team works effectively in delivering ingenious, economical solutions to our clients' briefs.

Our work encompasses conventional structural materials, such as brickwork, steelwork, timber and concrete, and newer materials like engineered timber, including Cross Laminated Timber (CLT), glulam and timber SIPs, Corten steel, and even carbon fibre. We also draw on the diverse experience of our practice to incorporate the latest structural glass and facade engineering principles.

We have engineered spectacular contemporary dwellings, from a cascading, concrete-framed house on the banks of the River Avon, to an exposed coastal residence with an elegant steel and glass structure.

Our team has negotiated exceptional site constraints, designing a corten-clad house directly adjacent to an active railway line, and an adjustable steel and timber holiday home set within an active landslip zone.

Our expertise in redeveloping heritage structures means that we have also been responsible for a vast array of refurbishment and extension projects. These have included significant basement extensions, the transformation of structures in conservation areas and the sensitive redevelopment of listed buildings.

**200+**
private homes
projects

# Centre Point

01

02

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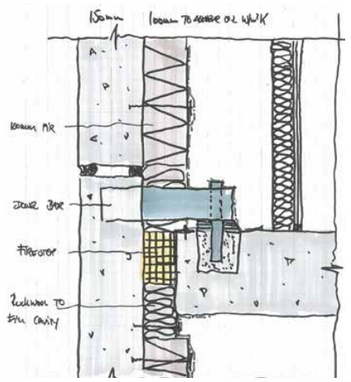


05

**Location: London, UK**
**Client: Almacantar**
**Architect: Rick Mather Architects | MICA**
**Date: Completed 2018**
**Value: £150m**
**Services Provided: Facade Engineering**

**Civic Trust Award 2019**

**New London Awards, Housing Category 2018 –** Commended

**Sunday Times British Homes Awards, 'Small Development of the Year' 2018** – Highly Commended

01
Centre Point link and retail space

02
12m tall sliding doors

03
White Lion House

04
Fabrication of precast concrete panels

05
Precast concrete slab edge

06
Facade scope of works

Centre Point, an icon of 1960s London, has undergone extensive refurbishment and conversion into a residential development, with a ground level podium of retail and leisure. A large public plaza replaces a busy traffic thoroughfare.

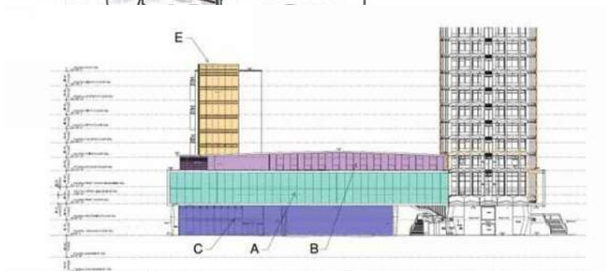
Eckersley O'Callaghan has acted as facade engineer on the retained and new-build elements for three of the project's main structures; Centre Point Link; Centre Point House; and White Lion House. All blocks have had 5m tall frameless structural glass retail facades inserted at ground level. The most prominent area of ground floor glazing is the retail unit beneath Centre Point Link, the link bridge between listed structures. The retail space required maximum transparency and minimum structure, which presented several challenges.

Large structural movements from the existing 1960s structure had to be accommodated by the glass within minimal head and base restraint details. The existing Grade II listed facades have been thermally upgraded and restored to new working order.

White Lion House is a new nine-storey residential block clad in embossed precast panels with punched windows and balconies. A quilted facade treatment on the east and west elevations features a chevron pattern echoing the forms of the Centre Point tower. The pattern development involved extensive prototyping.

All the facades have onerous acoustic requirements, and the numerous interfaces between new and existing structures have required careful consideration for weather-tightness and thermal performance.

**12m**
sliding glass doors





06

# The Bermondsey Project

01

02

03

**Location: London, UK**
**Client: Grosvenor**
**Architect: KPF**
**Date: Completion due 2022**
**Value: £500m**
**Services Provided: Facade Engineering**

Eckersley O'Callaghan is appointed as facade engineer on this multi-phase residential-led development incorporating around 16 new buildings and and the substantial refurbishment of two factory buildings.

The 5.4-hectare site encompasses the former Peek Frean Biscuit Factory and the former site of Lewisham and Southwark College. The project will see the completion of 1,300 rental homes, over 10,000m$^2$ of new office space, 10,000m$^2$ of retail, culture, leisure and community facilities and a new secondary school with 600 places.

Our team is involved in the facade design for all plots of the development. Phase 1 involves the refurbishment of the Biscuit Factory, and the design of two towers up to 100m in height.

In collaboration with the design team, we have developed facade systems that meet the architectural design intent, while satisfying cost and thermal performance requirements. This has been achieved by investigating material options and carrying out detailed analysis of thermal performance.

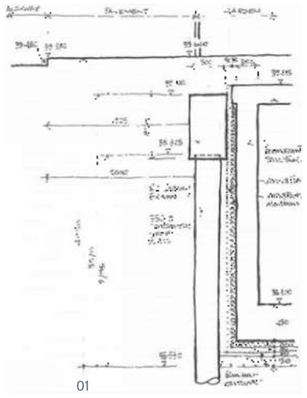
01
5.4 hectre site

02
Biscuit factory visualisation

02
Facade indicative patterns options inspired by biscuits



# Waldo Road



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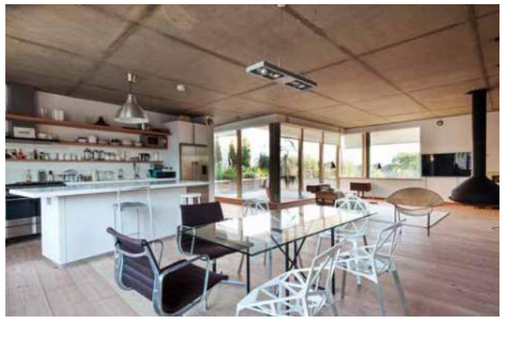


**Location: London, UK**
**Client: Alfred Munkenbeck**
**Architect: Munkenbeck + Partners**
**Date: Completed 2015**
**Value: Undisclosed**
**Services Provided: Structural Engineering**

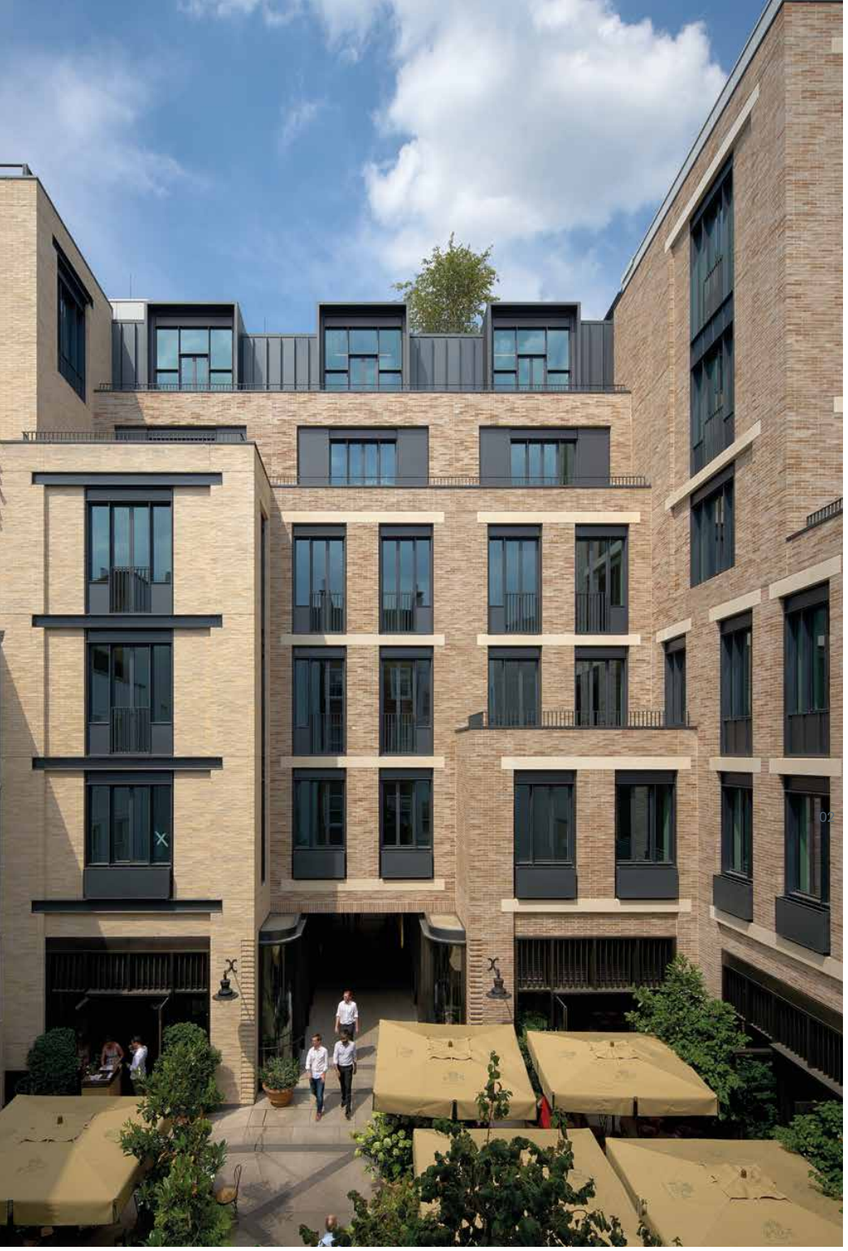
Eckersley O'Callaghan engineered the structural design of this challenging new private residences project. The new structure had to be constructed on a sloping site adjacent to mainline railway tracks in addition to retaining an existing highway and terraced houses on two sides.

Permanent contiguous piles were used on three sides of the site to retain the highway and terraced housing, whilst an inner reinforced concrete box housed the new structure. The inner box structure comprised a basement with swimming pools, ground floor, 1st floor. The roof of the 1st floor supported isolated timber framed pods.

The entire structure was founded on a reinforced concrete raft foundation. The upper floors were reinforced concrete flat slabs spanning between shear walls and isolated columns.

Detailed negotiations were held with Network Rail to ensure that the existing track-side brickwork retaining wall was not surcharged from the new foundations, and an anti-vibration mat was placed under the raft foundation to mitigate ground borne vibrations from the passing trains affecting the new structure and residents.

01
Basement section



01

02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07

01
Floral Court,
London

02
Wembley Park
E1 | 02,
London

03
Belle Vue,
London

04
Stamford Road
development by
Diamond Build
Group, London

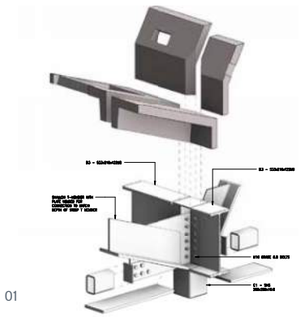
05
Waterman Tower,
London

06
Hill House,
London

07
Bridge Street
development,
Leeds

# Education & Research

# Science & Technology and Sixth Form Centres Sevenoaks School



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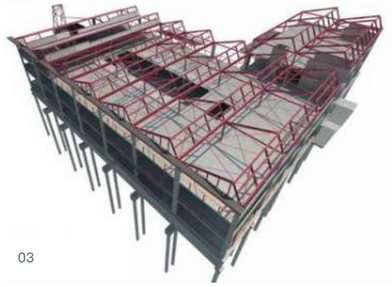


03

**Location: Kent, UK**
**Client: Sevenoaks Schools**
**Architect: Tim Ronalds Architects**
**Date: Completed 2018**
**Value: £23m**
**Services Provided: Structural & Civil Engineering**

**BREEAM Excellent**
**RIBA National Award 2019**
**RIBA South East Award 2019**
**Schueco Excellence Award** - Steel Project 2019
**RICS South East Design Through Innovation Award 2019**

This project is the latest in a masterplan for the long-term development of Sevenoaks School, a leading independent co-educational school. It provides a new science centre with 22 laboratories, technology workshops, offices, a sixth form centre, café and large multi-purpose space that can be used for exams.

Concrete played a vital role in the building's architectural and engineering conception. A precast ribbed roof structure is the project's standout feature, facilitating 7m-wide pitched spans with a slender appearance, while maintaining the concrete aesthetic, integrating services and providing thermal mass to the upper floor. A series of north lights brings diffused natural light into the laboratories and the dramatic central atrium. Steelwork framing elevates the precast panels into these skylights. Extensive detailing and coordination, carried out through BIM and the building's Revit model, fine-tuned the setting out of the ribs, the relationships with the steel framing and the services strategy.

In situ concrete is used in a variety of ways throughout the project and is integral to the function, aesthetics and performance of the building. Precast concrete stair flights are used in the building with similar exposed finishes. The imposing mass of the exposed concrete is offset by elegantly detailed features in several areas of the building, including glazed steel canopies, glass display vitrines and light steel framed balustrades. Two freestanding atrium stairs were fabricated in steelwork offsite and delivered and lifted into position through the partially completed roof structure as completed elements.

The building is embedded into a sloping site and an additional reinforced concrete basement level contains storage and plant spaces. The SUDS drainage design includes areas of permeable landscaping and soakaways.

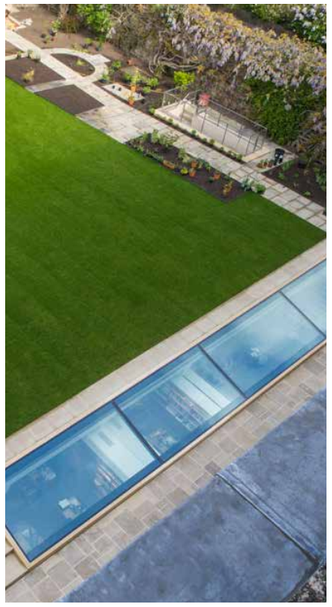
01
Detailed model of roof connections

02
Laboratories and workshops

03
3D structural model of building



# New Library and Archive The Queen's College



01

02

03

**Location: Oxford, UK**
**Client: The Queen's College**
**Architect: Rick Mather Architects | MICA**
**Date: Completed 2017**
**Value: £7m**
**Services Provided: Structural Engineering**

**RIBA South Award 2018**
**RIBA South Conservation Award 2018**
**Oxford Preservation Trust New Building Award 2018**

Founded in 1341, The Queen's College is one of the University of Oxford's constituent colleges. Its spectacular Grade I-listed library dates from 1692 and is one of the largest of any Oxford college, with a lending collection of 50,000 volumes and nearly 150,000 volumes in the historical collection. Requiring more room, and with surrounding space being limited, the only feasible place to accommodate an extension to the library was beneath the provost's garden.

Eckersley O'Callaghan designed the structural scheme for this new basement. The basement sits in particularly sensitive surroundings, immediately adjacent to and below the existing library, with fragile historic walls on either side. We used a secant piled perimeter wall, propped during excavation to retain the surrounding ground and to minimise movements of the adjacent foundations.

Movement monitoring helped to control the process. The connection to the existing library was particularly complex, requiring careful underpinning to the old wall.

Key to the design was ensuring that the library's valuable collection was protected, while at the same time accommodating the needs of its users. A rooflight running from north to south introduces natural light to the reading room, with the historic collection stored away from this light. Our structural glazing experience allowed us to provide key advice for the walk-on rooflight, and also for a glazed lift shaft.

The basement roof supports new planting to reinstate the existing provost's garden, leaving only the rooflight and access stairs as visable evidence of the basement.

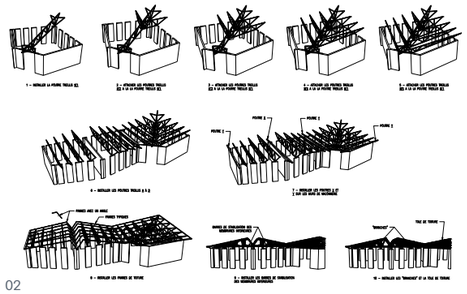
01
Construction of basement

02
New library

03
Rooflight in provost's garden

# La Référence de Ganthier

01



02

**Location: Ganthier, Haiti**
**Client: KONEKTE**
**Architect: Studio PHH**
**Date: Completed 2020**
**Value: $350,000**
**Services Provided: Structural Engineering**

**IstructE Award Sustainability 2019**
**Construction News Awards International Project of the Year 2019** - Shortlisted
**IStructE Award Structure in Extreme Conditions 2019** - Shortlisted

Eckersley O'Callaghan contributed engineering expertise to support the building of La Référence secondary school in Ganthier, Haiti, with charity KONEKTE and New York-based architects Studio PHH. Our involvement in the project forms part of our commitment to charitable causes.

The earthquake in January 2010 destroyed many schools, homes and livelihoods. Haiti is the poorest country in the Western Hemisphere where 70% of children do not attend secondary school and the illiteracy rate is about 60%.

Phase 1 of the project began on site on disused land in July 2017 and completed in October 2018, providing classrooms for 150 students. Phase 2 completed in 2020, adding three further modules and accommodating another 300 students. Once Phase 3 completes, the school will provide education for 600 students in total.

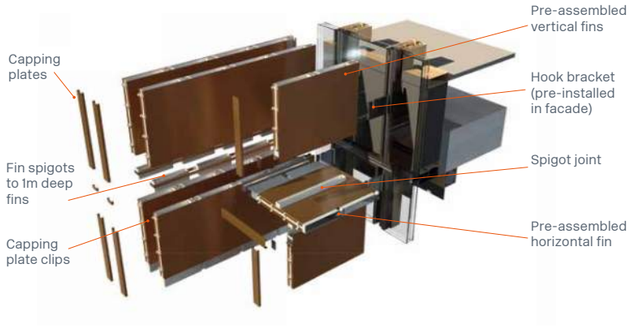
The structural design is suitable for local materials and basic building skills; developing a robust, safe, yet flexible building system that is resilient to seismic loading. The structures are compliant with the new building code CNBH 2012 that was based on US building standards and established after the earthquake.

01
Construction of structure

02
Construction stages



# The Beecroft Building




01

**Location: Oxford, UK**
**Client: Oxford University**
**Architect: Hawkins\Brown**
**Date: Completed 2017**
**Value: £50m**
**Services Provided: Facade Engineering**

**BREEAM Excellent achieved**
**RIBA National Award 2019**
**RIBA South Award 2019**
**RIBA South Building of the Year Award 2019**

The Beecroft Building is a landmark research and teaching facility for the University of Oxford Physics Department. Eckersley O'Callaghan provided facade engineering services and the design and detailing of the complex curtain walling systems, incorporating a variety of innovative materials including over 2km of copper & bronze shading fins.

Demanding performance targets drove the adoption of a unitised curtain walling system in the main facade. Choosing this system at an early stage meant it could be tested while the 16m deep basement was constructed. A key challenge then became the design and installation sequencing of the 700mm deep, cantilevering copper fins which were supported back to the unitised system.

Stringent thermal performance requirements meant that secondary structure and thermal penetrations had to be minimised while avoiding large cantilever loads on the curtain walling system and thermal bridging.

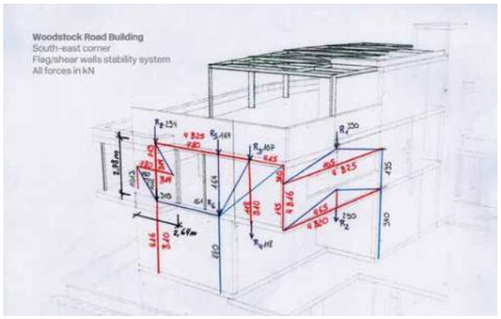
The facade contributed significantly to the building achieving a BREEAM Excellent rating, through a fabric-first passive approach with extremely low U-values, passive solar control, and a mixed mode ventilation strategy. The shading fins on the optimised grid allowed the use of highly transparent glass, permitting ample diffuse daylight to reduce artificial lighting demands. All these steps allowed the use of an extremely efficient M&E system in the upper floors, freeing up valuable plant space for the cutting-edge M&E systems required in the basement labs.

The fin support strategy also meant that they were not subject to wind induced vibrations transferred back to the primary structure, which was a key driver for the highly sensitive equipment in the laboratories. The laboratories have subsequently been recognised as some of the 'stillest' places on the planet.

01
On-site assembly

# H B Allen Centre
# Keble College

01

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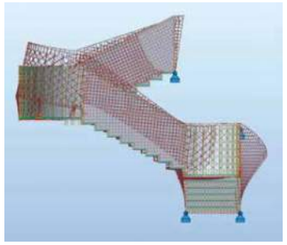

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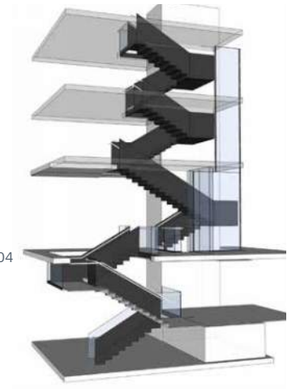

04

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06

07

**1200t**

equivalent of $CO_2$ saved using cement replacement materials

**Location: Oxford, UK**
**Client: Keble College**
**Architect: Rick Mather Architects | MICA**
**Date: Completed 2019**
**Value: £57m**
**Services Provided: Structural & Civil Engineering**

01
Retained Acland House on piles

02
Strut-and-tie model confirming distribution of forces in walls

03
Metal staircase model analysis output

04
Cantilevering staircase

05
Architectural model

06
New basement

07
Retained Acland House

08
3D structural model of HB Allen Centre

As part of Eckersley O'Callaghan's established relationship with Keble College, we have provided structural engineering services for the HB Allen Centre, a large mixed-use academic complex. We have worked with the rest of the design team since initial design in 2007 to fully detail the building.

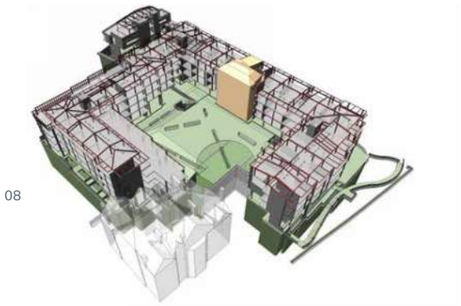
The development provides new residential space for 250 students, a new lecture theatre, library, café, seminar spaces, leisure facilities, and a further standalone academic building. A driverless car research group will be one of the occupants of a large new basement, which features a car lift to serve their needs.

With the uses of the building varying across multiple levels, from student living space to advanced specialist research facilities, it has been essential that the structural design is carefully coordinated to meet the services requirements at every level.

A key challenge involved retaining the Grade II-listed Acland House, which was temporarily supported on large piles and a reinforced concrete transfer slab during the excavation of the new basement. With the basement slab formed, new walls were constructed, and the building's load was then transferred onto them. The use of a raft slab foundation negated the need for 500 piles.

The basement and upper floors have a reinforced concrete frame, which is crowned with a steel frame roof structure. The equivalent of 1200 tonnes of $CO_2$ have been saved through the specification of cement replacement materials (55% GGBS).

Three cantilevering steel-and-glass staircases act as focal points within the building, each designed according to its individual situation. The staircases act as unifying architectural details within the structure.



08

# Mountview Academy of Theatre Arts

**Location: London, UK**
**Client: Mountview Academy**
**Architect: Carl Turner Architects**
**Date: Completed 2018**
**Value: £20m**
**Services Provided: Structural Engineering**

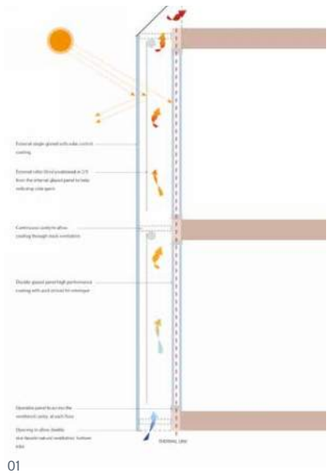
This new facility for the Mountview Academy of Theatre Arts is set in the heart of Peckham. The building comprises two distinct blocks; one for studio and the other for theatre. The studio block includes acting and dancing studios, TV black boxes and cafés, located over four floors. The theatre block includes a 200-seat theatre space, a lettable space, and an additional rooftop café.

Eckersley O'Callaghan has engineered the structure of the academy, which is primarily a concrete frame, utilising a precast lattice slab construction to achieve the longer spans across the dance studios. This has been designed with floor vibration sensitivity in mind. The flooring system meets the natural frequency requirements in these spaces and gives an architecturally expressed concrete finish. A reinforced concrete frame encloses the theatre auditorium, which itself is formed in structural steel to accommodate the complex geometries. Acoustically resilient restraint brackets are used to separate the building from the surrounding concrete frame while providing lateral restraint. Supported by lightweight timber frames, the sawtooth shape of the roof has large openings to maximise north light into the main acting and dance spaces. The exterior character of each block is distinguished with different cladding materials; corten steel for the theatre block and brickwork for the studio block.

The client initiated the project with an aim to keep costs significantly lower than the benchmark of £3500/m$^2$ for similar-use academies. By drawing and costing structural options, and building with different specification levels of finishes, we have been able to work with the client team to match expectations to the delivered building. The final structure provides robust but economic finishes and gives the academy the flexibility and the potential to develop the building further in the future.



# Wadham College



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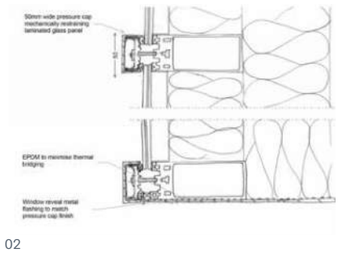


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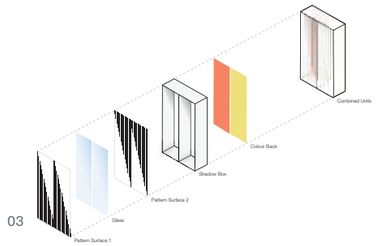



03

**Location: Oxford, UK**
**Client: Wadham College**
**Architect: AL_A**
**Date: Completed 2021**
**Value: Undisclosed**
**Services Provided: Facade Engineering**

Eckersley O'Callaghan is providing facade engineering services for two new buildings on Wadham College's historic Oxford site. The William Doo Undergraduate Centre will contain a range of social spaces to enhance and improve the interactions of the Wadham student community. The Dr Lee Shau Kee Building creates a welcome centre for prospective students visiting one of the college's inspiration days or summer schools.

The intent of the Dr Lee Shau Kee Building is to be light and uplifting. The facade is composed of opaque areas which are clad in glass panels with contrasting vertical metal fins between them. Windows are inset. The opaque modules are formed between the framework of metal fins and are in essence a series of shadow boxes. Each box has a metal backing at the rear and a glass panel at the face. A pattern is applied to the glass panel, subdividing the module and reinforcing verticality, while creating texture on the facade at a finer scale.

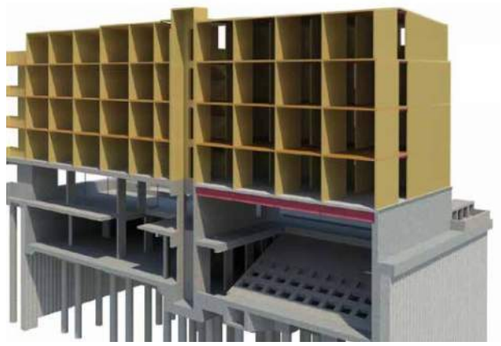
The facade of the Undergraduate Centre plays with a similar idea of varying degrees of transparency, but in a distinct way that reflects its own identity and function. The Undergraduate Centre wants to be an expression of horizontality, which is visible through the pattern applied to the glass facade. The facade of the Undergraduate Centre is composed of panels of clear and opaque glazing with an applied pattern of ceramic fritting to provide solar control in combination with insulated areas of facade.

01
Early facade design strategy for the William Doo Undergraduate Centre

02
Opaque facade shadowbox detail at window reveals showing vertical anodised aluminium expressed capping profiles

03
Opaque facade buildup option of Dr Lee Shau Kee building

# The Hands Building Mansfield College



01

02


03

**Location: Oxford, UK**
**Client: Mansfield College**
**Architect: MICA**
**Date: Completed 2017**
**Value: £14m**
**Services Provided: Structural & Civil Engineering**

**Structural Timber Awards 2018** - Shortlisted
**RIBA South Awards 2019** - Shortlisted

Eckersley O'Callaghan designed the original structural scheme for this student accommodation building, which gained planning permission in 2008. Since then, a double-height basement has been added to house the Bonavero Institute of Human Rights, including an auditorium, a 200-seat lecture theatre and seminar rooms.

The Hands Building comprises 78 en-suite student bedrooms, together with a common room and staff offices. The building has been constructed from an arrangement of cross-laminated timber (CLT) walls and floors, a prefabricated form of construction that reduces build time, the number of deliveries required to the site, and therefore disruption to the surrounding campus. It also reduces environmental impact, due to timber's sustainable attributes. The exterior facade is clad in stone with prominent use of structural glass.

The two-storey basement is a reinforced concrete box, sitting deep in a high water table. A limited number of internal supports allow for the large spaces required in the brief. The base of the concrete box forms a raft slab foundation that supports the structures above, with a dual system of a cavity drain and waterproof concrete providing waterproofing protection. Temporary props and dewatering facilitated the construction adjacent to several important existing buildings.

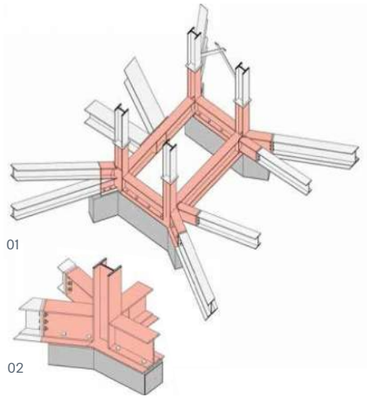
01
3D model of structure

02
Installation of CLT walls

03
Bonavero Institute of Human Rights



# Alleyn's Lower School



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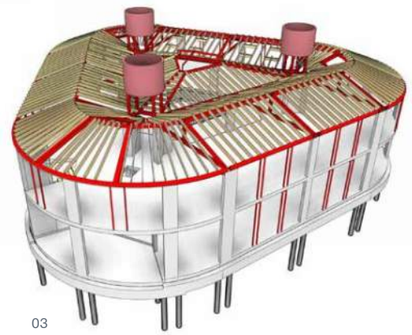


03

**Location: London, UK**
**Client: Alleyn's School**
**Architect: Tim Ronalds Architects**
**Date: Completed 2018**
**Value: £4m**
**Services Provided: Structural Engineering**

**RIBA London Awards 2019**

Alleyn's School required a new building to replace the existing Lower School building, which was in poor condition and too small for the school's needs. Increasing the number of classrooms from 8 to 12, the new Lower School also includes an assembly room and amenity space, and contributes additional play space and bicycle storage for its 240 pupils.

The building uses an exposed frame of in situ reinforced concrete up to the first floor, which provides thermal mass to the building, while the roof is formed from steelwork and Douglas fir timber rafters – both carefully detailed and exposed on the soffits at first floor level. Brickwork is used for internal and external walls, giving a robust, hard-wearing finish.

A Sustainable Drainage System is used beneath the playground for attenuated rainwater storage.

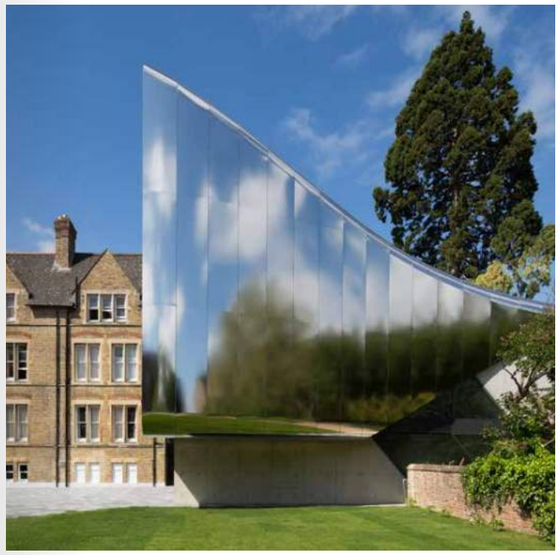
Eckersley O'Callaghan has engineered the structural design of the new Lower School and a separate extension to the school's science building. In addition to this we have also engineered a new drama centre, multi-purpose studio space, and sixth form centre. The works are part of the planned redevelopment of the School's western end, which will, in time, also include new spaces for dining.

01
Chimney area structure

02
Chimney area connection detail

03
3D model of structure

01



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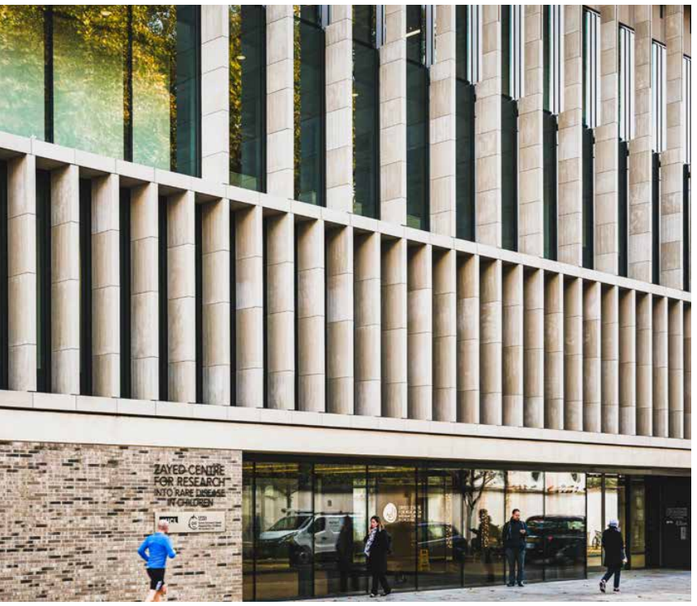


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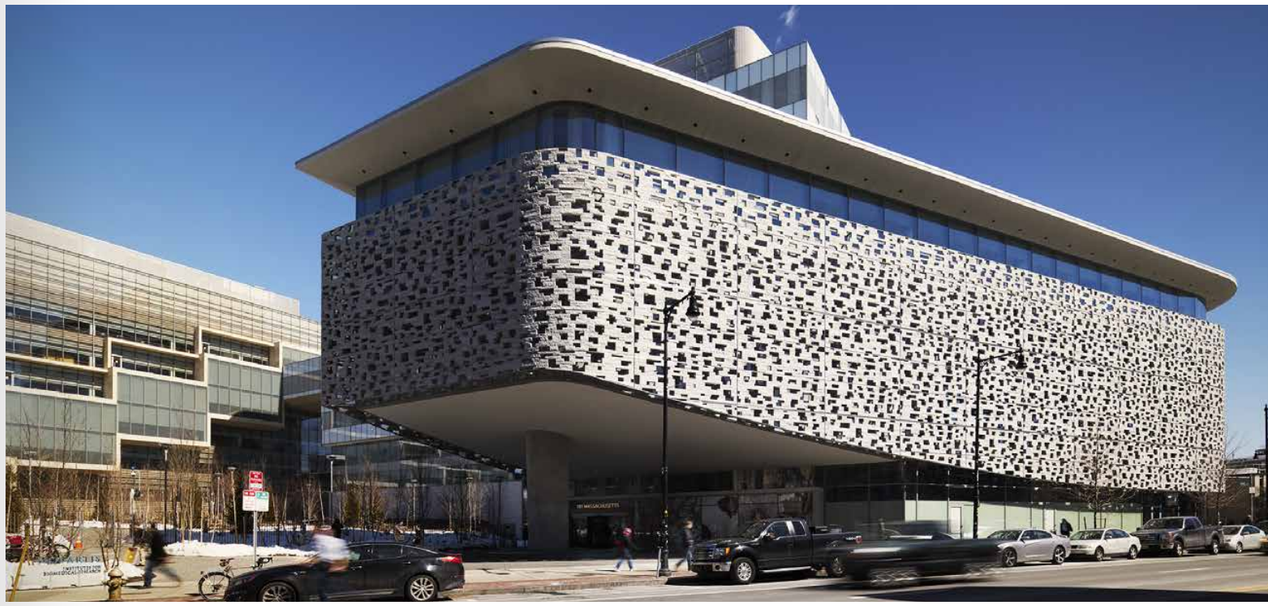


06

01
NASA Mars
3D-printed Habitat
visualisation

02
Investcorp Building,
St Antony's College,
Oxford

03
International Agency
for Research on
Cancer (IARC)
Headquarters,
Lyon

04
International Agency
for Research on
Cancer (IARC)
Headquarters,
Lyon

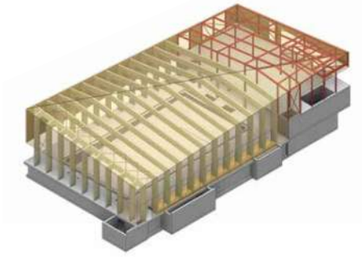
05
Honourable Society
of Lincoln's Inn
Fields,
London

06
Novartis Institute
for Biomedical
Research,
Cambridge,
Massachusetts

# Culture & Leisure

# Swimming Pool
# City of London Freemen's School

01



02

**Location: Ashstead, UK**
**Client: City of London Freemen's School**
**Architect: Hawkins\Brown Architects**
**Date: Completed 2017**
**Value: £8m**
**Services Provided: Structural Engineering**

**RIBA National Award 2018**
**RIBA South East Award 2018**
**RIBA South East Client of the Year Award 2018**
**RIBA South East Sustainability Award 2018**
**Structural Timber Awards 2018**

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Eckersley O'Callaghan provided structural engineering services for a new swimming pool for City of London Freemen's School, replacing the original pool, which was destroyed by a fire in 2014. This new six-lane, 25-metre competition pool is surrounded by woods and parkland and the school's Grade II*-listed Main House. The scheme also includes changing facilities, an annex, and energy centre.

The design involved the development of an envelope of cross-laminated timber, with minimal structural steel inserts, supported by long-spanning portal frames in glulam timber, which are gradually skewed along the length of the building.

The project utilises the very latest in energy-efficient ventilation systems hidden below the pool structure to service the building. Finished to a very high standard, the engineered wood has been left exposed internally and treated with a white stain, leaving the grain visible. This natural finish allows the building to complement its natural setting, and provides thermal insulation and corrosion resistance.

The site is located in an area of chalk, which is liable to corrosion over time – we engineered a foundation solution to minimise this risk while carrying the weight of the superstructure. We were also responsible for the detailed design of all reinforced concrete and steel elements.

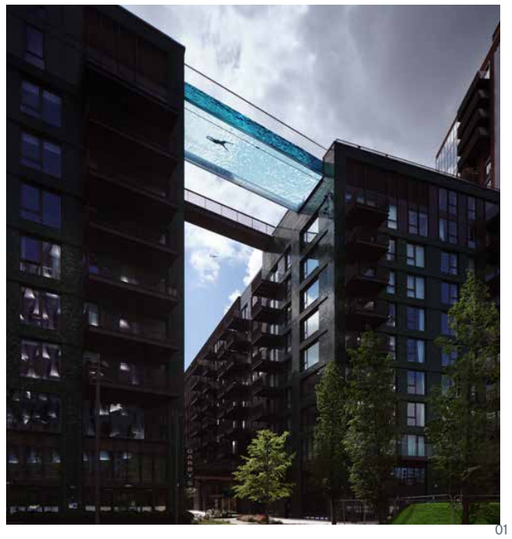
A complex geometrical layout demanded that we employ the latest 3D BIM tools to model these forms throughout the close coordination process with the design team. This BIM model was later used by the contractors for developing construction information.

01
Construction of CLT structure

02
3D BIM model of structure



# Sky Pool



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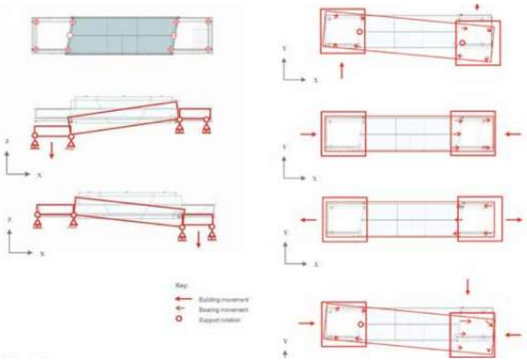

**Location: London, UK**
**Client: Ballymore**
**Architect: HAL Architects | Arup Associates**
**Date: Completed 2021**
**Value: Undisclosed**
**Services Provided: Structural Engineering**

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The world's first fully transparent swimming pool, Sky Pool is a lightweight structure that bridges the 10th floors of two residential buildings which form part of developer EcoWorld Ballymore's Embassy Gardens development in south London.

Constructed in clear acrylic, the side walls of the pool are 180mm thick, 3.2m deep and its base is 360mm thick. The whole pool weighs 50 tonnes and contains a total of 150 tonnes of water (100 tonnes of which is carried by the acrylic 'bridge').

Because of its size, Sky Pool was constructed in separate sections with transparent bonded joints cleverly designed to maximise the bond area and avoid areas of high stress.

While Sky Pool forms the spectacular centrepiece of the new Estate, allowing swimmers a dizzyingly clear view of the park 35m below, Eckersley O'Callaghan addressed some significant engineering challenges when developing the structural solution for this project. The side walls, for example, form deep beams capable of spanning the 15m distance between the buildings, whilst carrying the weight of the water, and resisting the hydrostatic water pressure on the sides and the wind loads.

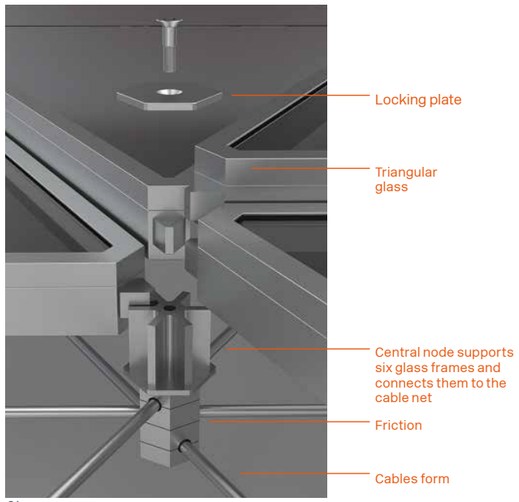
In addition, the two buildings are subject to normal movements, which are inherent to buildings of this scale including wind sway and foundation settlement. The pool structure deals with these movements by avoiding rigid connection at both ends; it slides on bridge bearings whilst maintaining watertightness.

An additional 5m length of pool sits over the buildings at each end – constructed in stainless steel – to make a total length of 25m. They are tied together across the acrylic by two high strength, spring-tensioned, stainless steel rods 38mm in diameter which sit beneath the pool.

A bonded acrylic structure also offers less intrusive joints and connections and greater transparency. The refractive index of acrylic, close to the value for water, will also result in much less distortion when viewing through the water or from outside.

01
Accommodating building movements

# ICONSIAM Wisdom Hall




01

**Location: Bangkok, Thailand**
**Client: SiamPiwat**
**Architect: Luke Lowings**
**Date: Completed 2018**
**Value: £3.5m**
**Services Provided: Glass | Facade Engineering**

Facing towards the Chao Phraya River, ICONSIAM is a new national landmark for Thailand and an unprecedented breakthrough in all-glass design.

ICONSIAM extends over three storeys and, at its highest point, is home to the Wisdom Hall – a museum celebrating Thai history and culture – whose unique triangular front facade and glazed sidewalls were engineered by Eckersley O'Callaghan.

We were challenged to design an  triangular frame with sides that span over 20m and can support cable loads, while also considering constructibility and allowing for the anchorages to be hidden within the cross section. Our solution avoided any internal structural elements, using the external shading fins as the support structure.

The complex assembly of the 20m tall system undertaken by Seele, was largely done on site to account for the significant sizes. The triangular frame was welded together, and the cable net tensioned on top of a crash deck. The two lower corners of the frame were attached to the main structure using pins that allowed the whole assembly to rotate into position while being pulled from the apex.

The sidewall glazing is made up of 72 pieces of on-site bent glass. Providing contrast to the cable net, the truss structure is positioned externally and is clad with an aluminium skin to provide shading to the interior.

Standing 20m tall and weighing 80 tonnes, the cable net is formed with clamps that support up to six glass panels each to provide an optimum view of the river and the city.

Overall, the facade consists of 64 triangular panes of glass held in place by 14 tensioned steel cables connected at 21 nodes and works in a similar way to the strings of a tennis racket. As all structural elements and connections are visible, we worked very closely with the architect to realise the design intent of transparency.

01
Supernode connecting and supporting 6 glass panels each



# K11 Arts and Cultural Centre

01

**Location: Hong Kong**
**Client: New World Development**
**Architect: KPF | SO-IL Architects**
**Date: Completed 2020**
**Value: Undisclosed**
**Services Provided: Glass | Facade Engineering**

Located at the top of the multi-storey K11 development, the cutting-edge Art & Cultural Centre in Hong Kong's cultural district is wrapped around a rooftop sculpture terrace with magnificent views out across the city.

Eckersley O'Callaghan worked with SO-IL architects and specialist contractor Seele to engineer a tubular glass facade that would envelop the curved spaces and create a distinctive visual statement.

Unique and ground-breaking, this sculptural glass facade pushes new boundaries in fabrication, installation, and the advancement of the closed cavity facade system (CCF) used. It consists of 300 glass half and full tubes (9m tall and 900mm diameter), wrapping 170m around the sixth and seventh floors.

Translating SO-IL's vision into reality required a process of research and working collaboratively with the client, architect, fabricators and M&E consultants to overcome the never-been-done-before aspects of the design.

The facade underwent year-long testing and development before it was installed on site.

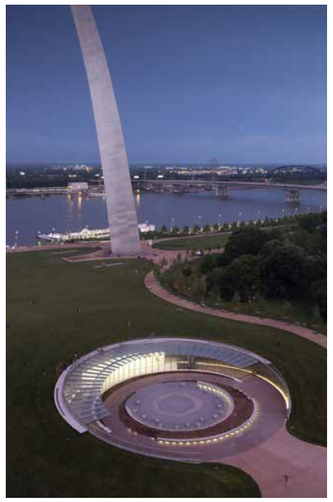
Producing glass tubes of such tight radius on this scale had not been done before, either. Having investigated different fabrication techniques to produce the tubes, the project used gravity bending to slump the heated flat sheets of glass over a mould and join the two halves. Considering the curvature of the glass, we were able to minimise the thickness of the build-up which in turn increased its transparency.

All tubes are base supported, with the panels over the entrance and openings supported on the adjacent full-height glass cylinders via a mechanical connection bolted through the glass. Movements from the supporting structure are accommodated through vertically released connection details at the top restraint.

The tubes have been designed to withstand typhoon loading, with climatic loading and condensation being another consideration. The required volume of air to be circulated in the facade far exceeded that in a traditional double layer facade, requiring a novel solution. Together with Seele, we were able to implement a new, state-of-the-art CCF system within the tubes to stop the risk of condensation building up.

01
Fabrication of tubes by Seele

# Museum at the Gateway Arch



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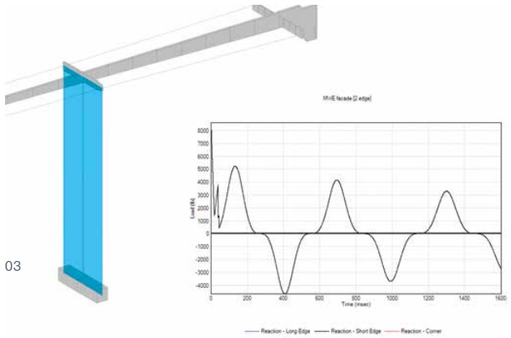




03

**Location: St Louis, USA**
**Client: Gateway Arch Park Foundation**
**Architect: James Carpenter Design Associates**
**Date: Completed 2018**
**Value: Undisclosed**
**Services Provided: Structural Engineering**

Eero Saarinen's emblematic 1950s museum beneath the St Louis Arch commemorates the Louisiana Purchase and the foundation of the modern United States. It's new centrepiece west entrance expands the museum, and merges iconic historical architecture with modern technology.

The existing building, which is largely underground, is now supplemented with a curved glass facade entrance. Three-hundred feet long, the structure uses custom blast-engineered structural glass panels.

Eckersley O'Callaghan developed an innovative pre-stressed structure with preloading tendons hidden within the glass joints. This allows the cantilever glass canopy to be achieved with minimal stainless steel framing, realising the architect's brief for maximum transparency.

The cantilever and rod system uses 24-inch bolts to hold the cantilever in place and the structure is tuned for optimal blast performance using ductile plastic hinge failure mechanisms, designed to absorb the dynamic shockwaves in this seismic zone.

01
Curved glass facade entrance

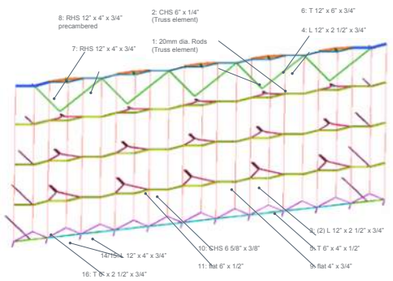
02
Mockup of 24 inch bolts holding cantilever in place

03
Blast analysis



# International Spy Museum

01




02

**Location: Washington DC, USA**
**Client: International Spy Museum**
**Architect: Rogers Stirk Harbour + Partners**
**Date: Completion due 2018**
**Value: Undisclosed**
**Services Provided: Facade Engineering**

**ENR MidAtlantic Best Project Award 2019 -** Best Cultural/Worship

The new International Spy Museum at L'Enfant Plaza in Washington DC features an iconic facade, which draws its inspiration from espionage and spycraft. Working with Rogers Stirk Harbour + Partners, Eckersley O'Callaghan designed a folded structural glass veil, suspended in front of the black box exhibition space to add a deceptive visual layer.

To meet the stringent budget, we rationalised the original curved glass design into folded plate glass panels that stand 17 feet high. A lightweight stainless steel structure stitches together the geometric folds, resulting in a thinner build-up of glass and lower costs.

At 140,000 square feet, the new museum building more than doubles the exhibition space for the world's largest collection of espionage-related artefacts, with new resources for educational programming, a lecture theatre, and a multifunctional rooftop event space with sweeping views of the city, where we have engineered the glazed facade.

Eckersley O'Callaghan also designed the facade for the ground floor lobby, which comprises of an aluminium curtain wall bonded by four-sided structural silicone.

01
Veil stainless steel structure

02
Preliminary facade structure

# Lafayette Anticipations

01

02

03

**Location: Paris, France**
**Client: Galeries Lafayette**
**Architect: OMA Architects**
**Date: Completed 2018**
**Value: Undisclosed**
**Services Provided: Structural | Facade Engineering**

**Equerre d'argent, Prix spécial du jury 2018**

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Lafayette Anticipations is a new contemporary art foundation in the Marais cultural district of Paris. An industrial building dating from 1891 has now been radically transformed into a multipurpose structure featuring 800m² of exhibition and performance space, an artists' atelier, and offices.

Working within the client's budget, Eckersley O'Callaghan developed the necessary alterations to the existing five-storey structure along with the new 'exhibition tower', ensuring the project stayed true to the architect's design intent.

The transformation of the existing U-shaped building included upgrading the basement levels into artists' workshops. A new public entrance has been created, linking 'Rue du Plâtre' with 'Rue Saint-Croix-de-la-Bretonnerie'.

A key element of the design concept, the insertion of the 18m-tall central steel-frame tower into the 21.5m by 20.7m courtyard, has reimagined the space into a five-story atrium with a glass roof. The combined steel and glass structure includes four mobile floors, offering 49 possible spatial and programmatic configurations to accommodate a range of artistic projects. A glass-clad stair and lift core structure has also been inserted, with ultra-thin Ductal stair flights and landings.

Throughout the project, Eckersley O'Callaghan's role was to provide intelligent structural solutions to a brief that changed as the original architectural proposals had to adapt to new city codes. The success of the building is a result of our close creative collaboration with the architect.

01
Exhibition space in steel-frame tower

02
Architectural model of possible spatial configurations

03
Movement of exhibition floor



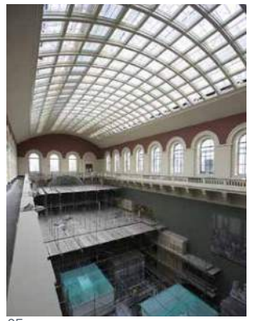
# V&A Museum

01

02

03

04



05

**Location: South Kensington, London**
**Client: Victoria and Albert Museum**
**Architects: 6a Architects | ZMMA**
**Date: 2010 - 2016**
**Value: £2m - £8m**
**Services Provided: Structural Engineering**

**IStructE Heritage Award 2016, V&A Europe Galleries shortlisted**

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The V&A is the world's largest museum dedicated to decorative art and design. The challenge of transforming this Grade I-listed building has tested a range of engineering skills – from structural frames that support the whole building to delicate display structures for every object.

We worked with the V&A as part of their design team Framework Agreement for over four years, transforming the V&A by revitalising visitor facilities and redisplaying the collections. We then successfully renewed our place on the Framework Agreement and continue to support the V&A with various construction projects.

Our involvement to date includes three large-scale projects, as well as several small-scale, more intricate commissions. All projects have required fundraising, including from the Heritage Lottery Fund, and our work and deliverables have been specifically tailored to suit this process.

In the **Europe 1600-1815 Galleries** we transformed the existing dark linear spaces, introducing more natural light. We opened up extensive new spaces by removing large sections of the massive loadbearing walls.

The **Fashion Gallery** saw an extensive refurbishment, with the mezzanine floor upgraded and a number of new elements inserted into the space.

In the **Cast Courts**, we engineered the design of a new glazed roof envelope to replace the existing patent glazing system, which sits on the 20m-span curved roof trusses.

01
Transformed Europe 1600-1815 Galleries

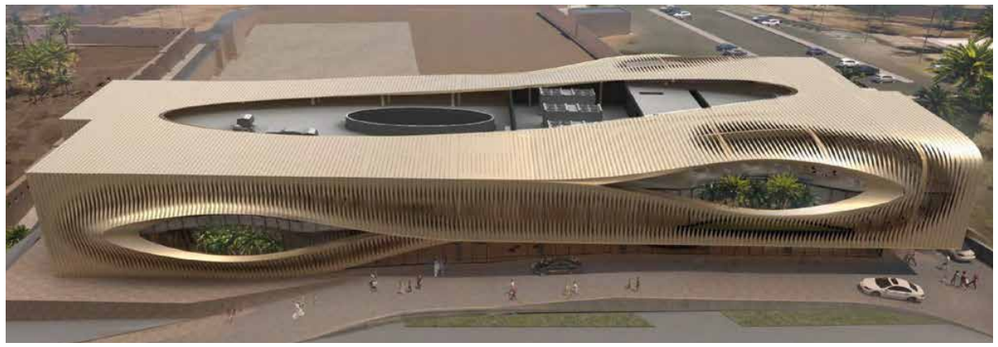
02
New steelwork frames open up previously back-of-house spaces

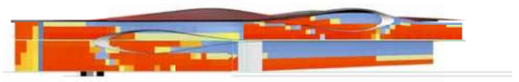
03 | 04
Fashion Gallery

05
Cast Courts

# Diriyah Urban Heritage Centre

06





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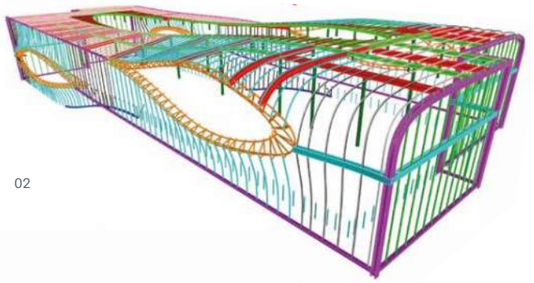
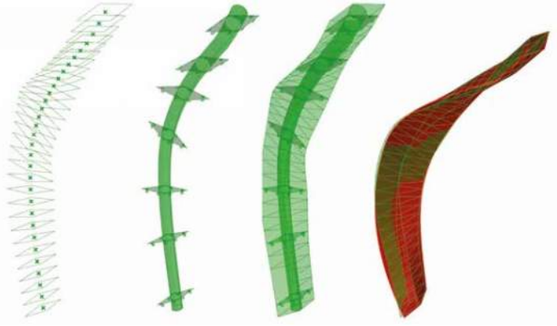


02



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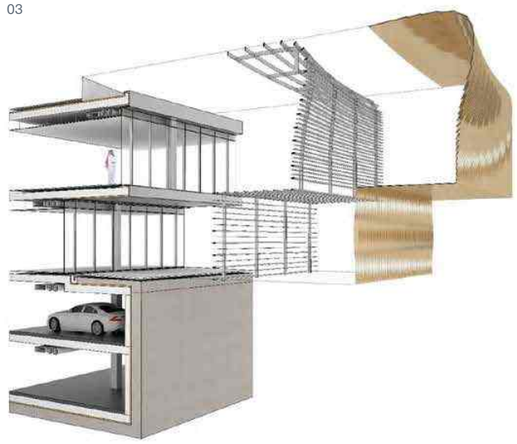


04

**Location: Riyadh, Saudi Arabia**
**Client: Saudi Commission for Tourism and National Heritage**
**Architect: Zaha Hadid Architects**
**Date: Completion due 2022**
**Value: Undisclosed**
**Services Provided: Facade Engineering**

01
Radiation analysis

02
Supporting structural optimisation

03
Fin optimisation studies

04
Facade exploded view

The historic walled city of Diriyah sits on the outskirts of Riyadh. Featuring multiple areas of archaeological significance, including a UNESCO World Heritage Site, it has been chosen as the location for Saudi Arabia's Urban Heritage Centre. The new 8000 $m^2$ museum contains exhibits and education spaces celebrating the country's architectural and cultural heritage, and establishes a scientific research centre for Diriyah's rich archaeological sites.

The region's desert climate has necessitated a facade strategy that can cope with extreme temperatures. Eckersley O'Callaghan has developed a glazed design, over-clad with an external shading screen of curved and twisted metal fins that give the building its distinctive sinuous form, while protecting the interior from the sun.

The external shading screen is a complex facade system, composed of free form metal cladding elements and secondary steel structure acting together to achieve great spans and cantilevers.

We have carried out detailed environmental analysis a to optimise the fin arrangement in both minimising solar gain and ensuring comfortable interior light levels, while also maximising views out to the museum's surroundings.

The twisting form of the fins has required extensive geometric rationalisation to achieve buildability, and extremely complex structural analysis so that the fins can achieve the slender profiles intended by the architect while maintaining structural stability.

**1500**
unique curved and twisted fins forming external shading screen

01

02

03

04

05

06

07

08

01
Tropicalia,
France

02
Woolbeding Gardens,
South Downs

03
Norman Foster
Foundation,
Madrid

04
Gainsborough's
House, Sudbury

05
Canoe Lake
Tennis Pavilion,
Portsmouth

05
Opera Terrace, Covent
Garden

07
SF MOMA,
San Francisco

08
South London Gallery,
London

# Transport & Infrastructure

# Lightwalk
# Gangnam Intermodal Transit Center


01

02

**Location: Seoul, South Korea**
**Client: Seoul Metropolitan Government**
**Architect: Dominique Perrault**
**Date: Completion due 2023**
**Value: Undisclosed**
**Services: Structural | Facade Engineering**

The Lightwalk is a unique thoroughfare beneath a large area of green space in the Gangnam neighbourhood of Seoul. Known as 'Greenland', the park sits over the GITC (Gangnam Intermodal Transit Centre), a multimodal transit station between a major convention centre (COEX) and the Global Business Center (GBC). The Lightwalk connects all three, creating a new circulation axis.

Eckersley O'Callaghan is providing engineering services for the project's design, which uses varying levels of reflection and refraction to diffuse natural light into the underground spaces. Advanced systems of thermal insulation and natural ventilation ensure the comfort and energy efficiency of the project.

The glass and steel structure is 600 metres long and 10 metres wide. It crosses the Greenland park at a depth of 10 metres, with an incline bringing it down to a depth of 20 metres at each end.

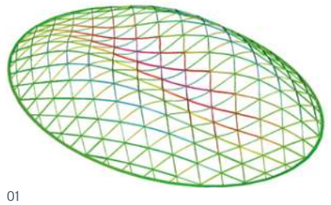
The Lightwalk comprises a waterproof double-layer envelope of a triangular and prismatic shape that's two metres thick. The inner skin and its associated panels are attached to a V-shaped stainless steel frame. The outer glass skin is laminated to create a continuous smooth surface.

01
Plan of 5 storeys of mixed use space

02
Walkway design using reflection and refraction of light



# Iona SkyDome



01

02

**Client: P&O**
**Date: Completed 2021**
**Services Provided: Glass Engineering**

Designed to be the focal point of Iona, P&O Cruises' most innovative ocean liner, the stunning, elliptical glass SkyDome is 131 tonnes, 41m long, 30m wide, 4.3m high and spread over two decks.

No structure of this complexity had ever been built on a ship before, with the space underneath featuring a poolside environment by day that transforms into an entertainment venue at night.

As such, the SkyDome's design had to overcome a number of substantial challenges, with weight minimisation a key consideration. To achieve this, the shape of the dome was optimised using gravity loading as a form-finding method for the roof geometry, as were the individual member sizes to use the minimum material possible. In doing this we also had to balance the weight with the dome stiffness so that the frequency of the structure was within the allowable range. Moreover, to reduce wasted glass material, the shape of each panel was defined based on the maximum width the glass panes could be cut.

The deformation of the support structure due to the ship movement under hogging, sagging and torque were applied in the FEA model. Apart from the movements at ultimate limit state, the impact of these movements on the behaviour of the dome against fatigue was also investigated.

As the ship will travel the world many times, the SkyDome also needed to be tested to withstand all kinds of climatic loads such as wind, snow, rain and hail – for which we conducted tests which involved firing 45mm diameter balls of hard packed ice, with mass 45gr at 30m/s terminal velocity.

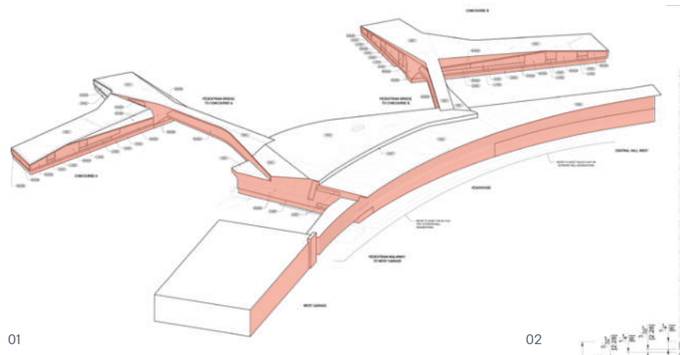
Thermal performance requirements had to balance temperatures ranging between +35/-10°C. To meet this, we used an insulated glass unit (IGU) with a high-performance coating, helping us to reduce the thermal losses (U-value = 1.6 W/m2K), limit the solar gain (g-value=0.34) and keep the transparency of the glass at a high level (Light Transmission =70%).

Given the SkyDome's unique structure and situation, Eckersley O'Callaghan also had to overcome strict design codes set by the marine regulatory bodies. This meant we had to take a sensitive approach to design, with each innovative aspect having to prove its structural capabilities from first principles and by rigorous testing before approval.

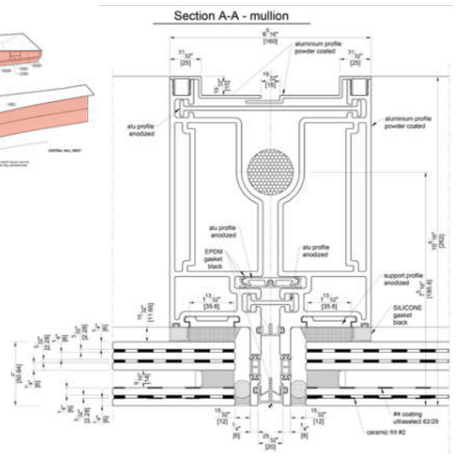
01
Finite Element Model of Global buckling of the gridshell roof

02
Installation of SkyDome onto cruise ship

# LaGuardia Airport



01




02

**Location: New York, USA**
**Client: Skanska Walsh Project CM**
**Architect: HOK**
**Date: Completed 2020**
**Value: £3bn**
**Services Provided: Facade Engineering**

LaGuardia Airport is undergoing a major transformation into a world-class facility, which will include a future air train, increased taxi-ways and best-in-class passenger amenities.

The first phase of the redevelopment of LaGuardia, includes demolishing the Central Terminal Building and creating a new central entry portal to the airport and unifying previously unconnected terminals.

Eckersley O'Callaghan has been involved in the engineering of the glass cable wall system for the main terminal building. The system comprises insulated glass units with aluminium frames installed on a system of vertical cables via clamps.

Our scope also included the concourses to the rear of the building which have a steel fin and glazed aluminium cassette system.

The cable glass wall system is designed to meet onerous criteria of blast resistance. By engineering 'fuse' connections that will undergo plastic yielding in the event of a blast, the energy is absorbed and limited in its transfer into the building structure.

01
Highlighted diagram of EOC scope of works

02
Cable detail



# Dilworth Park

**Location: Philadelphia, USA**
**Client: Center City District**
**Architect: Kieran Timberlake**
**Date: Completed 2014**
**Value: Undisclosed**
**Services Provided: Glass Engineering**

**AIA Pennsylvania Honor Award**
**AIA Philadelphia Gold Medal**
**Urban Land Institute Philadelphia, Willard Rouse Award for Excellence**

Dilworth Plaza is at the centre of the city of Philadelphia, in front of City Hall, and is a historic nexus of transportation. Eckersley O'Callaghan provided glass engineering services for two glass pavilions as part of a larger project to redesign Dilworth Plaza (renamed Dilworth Park). The pavilions are the two main entryways to the transportation network below. Perhaps among the largest constructions of laminated structural glass ever erected, the pavilions curve gently to the ground plane, seeming to slide under the central walkway.

Each pavilion is an all-glass structure rising from the ground with glass walls up to 18 feet high and a glass roof spanning 17 feet across the entryway. The glass wall panels are composed of five plies of 3/8" heat strengthened glass with Sentry Glass interlayer. The roof panels are composed of seven plies of heat strengthened glass with Sentry Glass interlayer.

The pavilions are supported below ground by steel beams and concrete slabs. The glass walls are captured within a stainless steel shoe and cantilever up from ground level. The roof panels are simply supported on the wall panels.

The design philosophy for the pavilion was to have no metal fitting above ground and join all the glass panels with structural silicone. This pays homage to the structure of the City Hall, which is the tallest all-masonry building in the world.

# M Y Venus

**Design: Phillipe Starck**
**Client: Rompetrol**
**Ship Builder: Feadship**
**Date: Completed 2012**
**Value: $100m**
**Services Provided: Glass Engineering**

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The client, whose experience was in the built environment, had a clear brief to use glass to its full potential within the marine environment. There was a desire to make large, structure free, glass walls enabling maximum visibility and openness rather than the traditional smaller 'porthole' window typology associated with larger ships.

We drew upon our extensive experience in large format glass and proposed to surround the pavilion deck by 10m long glass sheets slightly curved to the yachts lines and coated to provide a modicum of privacy while embracing the 360 views and maximising light.

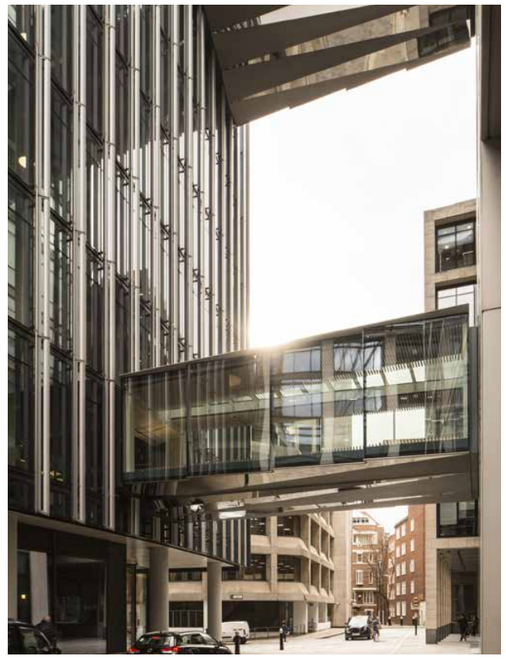
Technically the challenges involved designing the glass to substantially higher loads than are typically accommodated for in buildings. This resulted in laminated glass to resist loads while also needing to detail the glass to accommodate the significant movements experienced by the glass resulting from the ships natural flex.

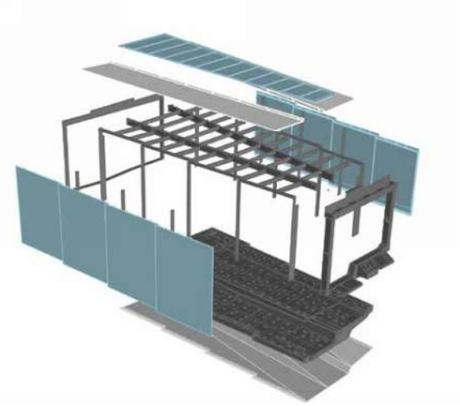
The challenge of the process of approvals and rules governing the yacht design world was met. We navigated this successfully to facilitate this ground breaking approach to glass in yachts using our experience and design tools along with a testing regime witnessed by Lloyds Register.

Since this project we have been active in the yacht design world and invited to speak at industry conferences on the subject of glass in yacht design.



# New Street Square Link Bridges





01

02

**Location: London, UK**
**Client: Deloitte**
**Architect: Wilkinson Eyre Architects**
**Date: Completed 2020**
**Value: Undisclosed**
**Services Provided: Structural | Facade Engineering**

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Eckersley O'Callaghan is collaborating with Wilkinson Eyre on the design of two footbridges linking nos. 1 & 2 New Street Square in the City of London following a design competition in 2015. The buildings are owned by Land Securities and occupied by Deloitte, with the bridges serving to connect the two buildings at the heart of the Deloitte campus.

The unusual form of each bridge was defined by the level change that occurs between the buildings. Rather than taking up floor space within the buildings, the necessary ramps and stairs occur within the bridge, giving each a folded plate origami-like form. Our structural design takes advantage of the folded plate to create a stiff steel monocoque deck with soffit panels of bead-blasted and mirror polished stainless steel sheet.

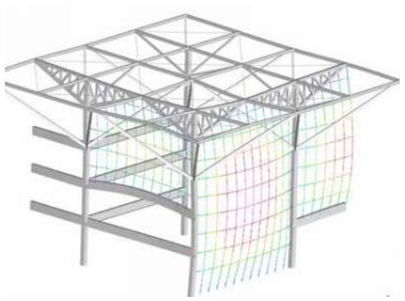
The large glazed vertical facade walls continues from soffit to roof between slender mullions at quarter points along the bridge. The roof is steel framed, with GFRP infill panels and a glazed strip roof light along the length of the bridge.

Our facade engineering team has solved the further challenge of seamlessly connecting the bridge envelope into the unitised facades of the adjacent buildings while accommodating large differential movements.

01
Exploded view of bridge structure and cladding elements

02
Installation of lower bridge

# Rosario Airport



01

**Location: Rosario, Argentina**
**Client: EPD**
**Architect: UPE Aeroporto**
**Date: Completion due 2021**
**Value: £250m**
**Services Provided: Glass Engineering**

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Located 200 miles northwest of Buenos Aires, Rosario is Argentina's third largest city. It is served by Rosario International Airport, which is currently undergoing a major redevelopment to accommodate increasing passenger traffic. The existing passenger terminal will be expanded, with a new international terminal constructed alongside it. The airport will remain operational throughout construction.

Eckersley O'Callaghan is engineering the airport's cable net facade, which is 20m tall and covers all four sides of the building. It also includes prestressed cables, glass panels and bracketry.

The main structure of the facade comprises a net of vertical and horizontal prestressed cables. The vertical cables form the primary structural elements, while the horizontal cables help to reduce the general deflection.

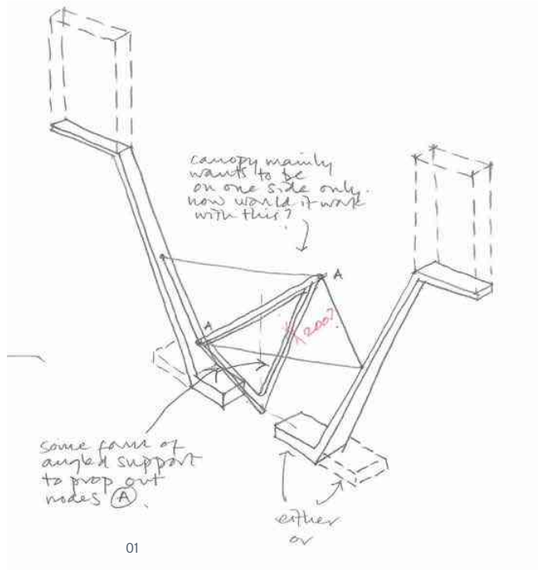
According to the different facade typologies (depending on the height), the vertical cables are bottom anchored to the concrete foundation or to the mezzanine steel beams. At the top, the cables are anchored to steel trusses cantilevering from the main steel columns of the building. Those columns also provide the anchor points for the horizontal cables.

IGU glass infill panels, approx. 1.25m wide by 2m high, forming the enclosure of the wall, are supported at the corner by the cables. The support is provided by means of steel clamps.

01
Cable wind
load analysis



# Two Towers


01

**Location: Manchester, UK**
**Client: Ocean Outdoor**
**Architect: SimpsonHaugh**
**Date: Completed 2018**
**Value: Undisclosed**
**Services Provided: Structural Engineering**

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Two double-sided digital advertising screens have been erected either side of the Mancunian Way, Manchester's busiest arterial route. The synchronised displays provide Manchester's largest audience reach from outdoor advertising, with over 3.6 million impacts every fortnight.

Eckersley O'Callaghan engineered the towers, which are both 18 metres tall. A key principle of the design was to minimise the visual impact of the screens' supporting structure by creating a slender profile.

The project involved several challenges. The complex dynamic response due to wind loads had to be analysed using finite element software. An innovative bolting system has allowed the screens to be installed separately from the base with fine adjustment, giving them the appearance that they are floating.

01
Structural Design

Woodhouse,
London, UK

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