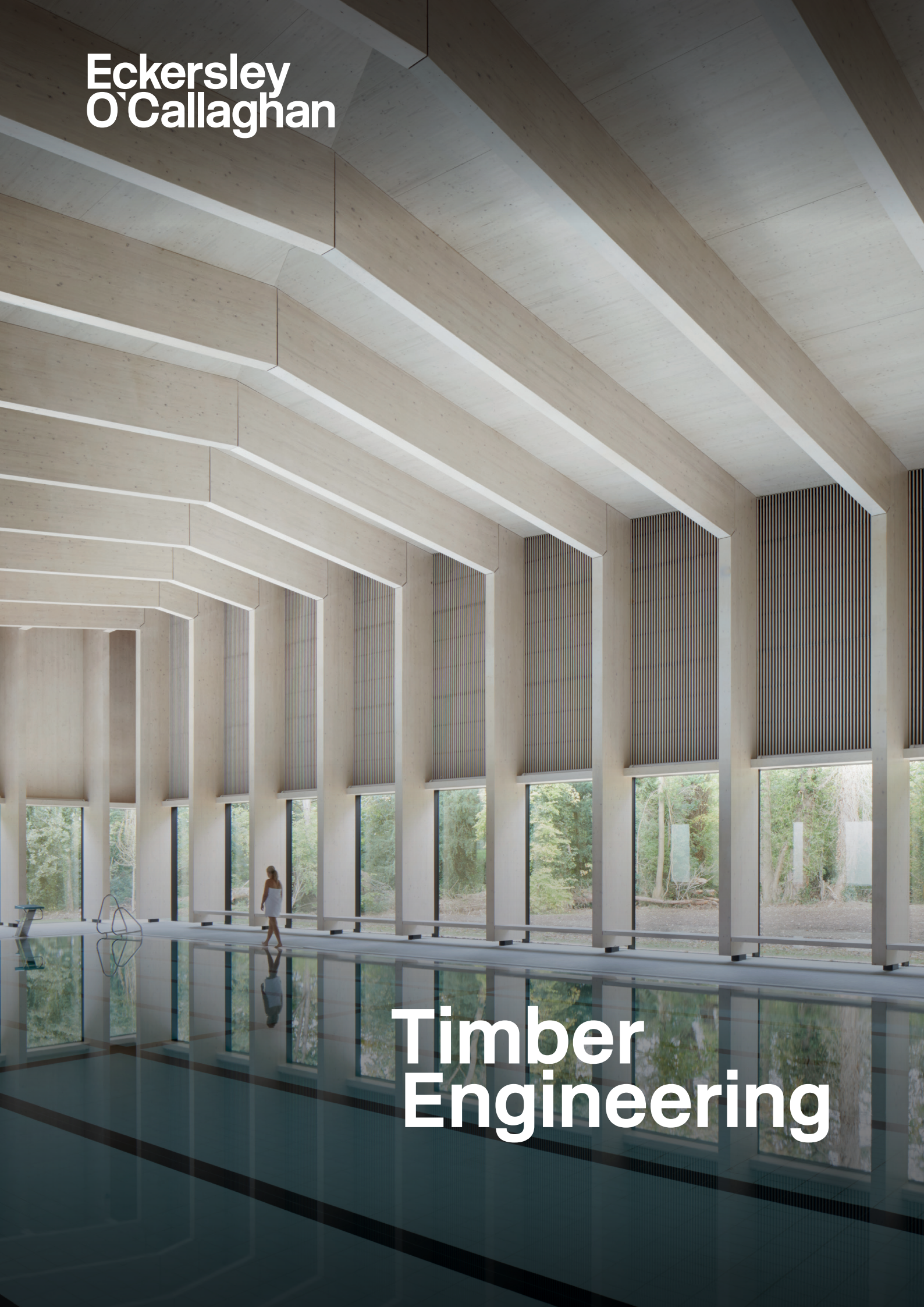
Eckersley O'Callaghan



Timber Engineering

Our experience with timber

Our experience in the design of timber structures is rich and varied, from unique private homes and inspiring education buildings to flexible warehouse buildings and innovative tall towers. Our structural engineers have specialised knowledge of timber design at both a conceptual and detailed level, giving us a unique perspective on the use of this sustainable material in the realisation of your project.

Through our work, we have developed strong relationships both nationally and internationally with timber suppliers and wood manufacturers. We have collaborated with most of the big European suppliers and UK-based installers. We study the wide variety of engineered timber products on the market to assess the benefits, drawbacks and value of each for the specific project at hand.

Depending on the particular structural, practical and architectural requirements, we have used Douglas fir, spruce cross laminated timber (CLT), glue laminated timber, laminated veneer lumber (LVL) beams, and columns of varying species from spruce to the finest beech.

Our most recently completed projects that make extensive use of timber include the multi award-winning Freemen's School pool building, Mansfield College student housing in Oxford, and sustainable furniture designer Vitsœ's visionary production facility.

We are currently designing projects at the cutting edge of the mass timber industry in both the UK and worldwide, including the net zero Black and White building in London and the ground-breaking new Atlassian Central tower in Sydney, set to become the world's tallest hybrid timber tower.

These projects use wood in combination with concrete, steel, masonry and glass in ways that complement or contrast each other to achieve the architectural vision.

Society of Facade Engineering Awards 2023, International Innovation – Mass Timber 1
Society of Facade Engineering Awards 2023, UK Innovation Award – The Black & White Building
Structural Timber Awards 2023, Commercial Project of the Year – The Black & White Building
Council on Tall Buildings and Urban Habitat Awards 2023, Future Project Award – Atlassian Central
Structural Timber Awards 2023, Winner's Winner – White Eagle Lodge
Structural Timber Awards 2023, Low Carbon Project of the Year – White Eagle Lodge
Wood Awards 2023 – White Eagle Lodge – Shortlisted
Construction News Workforce Awards 2022, Net Zero Team of the Year
The Architectural Review Future Projects Awards 2022, Best Office – The Black & White Building
RIBA National Award 2022 – Aisher House, Sevenoaks School
RIBA South East Award 2022 – Aisher House, Sevenoaks School
World Architecture Festival 2021, Future Office – Atlassian Central
Holcim Awards 2021, Sustainable Construction – Atlassian Central – Special Commendation
Structural Timber Awards 2020, Commercial Project of the Year – Promega Headquarters – Finalist
RIBA Regional Awards South 2020 – Promega Headquarters – Shortlisted
Holcim Awards for Asia Pacific 2020 – Atlassian Central – Bronze
Construction News Awards 2019, Construction Consultancy of the Year
RIBA South East Award 2019 – Sevenoaks School Science & Technology and Sixth Form Centres
Queen's Award for Enterprise 2018, International Trade
RIBA National Award 2018 – Freemen's School Swimming Pool
RIBA South East Sustainability Award 2018 – Freemen's School Swimming Pool
Structural Timber Awards 2018, Education Project of the Year – Hands Building, Mansfield College – Finalist
Wood Awards 2018, Education & Public Sector – Freemen's School Swimming Pool – Commendation
Wood Awards 2018, Structural Award – Freemen's School Swimming Pool – Commendation

Promega Headquarters, Southampton, UK

Practice Profile

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

11
global offices

180+
industry awards

67%
of our work is from repeat clients

Since forming in 2004, our team has grown to 140 across offices in London, Manchester, New York, San Francisco, Los Angeles, Paris, Milan, Hong Kong, Shanghai, Delhi and Sydney.

We have established an international reputation for our creative, yet rigorous, approach to engineering structures and designing facades. We work on a range of extraordinary building projects across the world, from complex structures of timber, steel or concrete, through to bespoke glass designs and specialist heritage projects.

Our innovative work has received some of the highest accolades in the industry, and we are synonymous with pioneering new advances in design and engineering. Our engagement with architecture and industry underpins our pioneering use of materials to realise projects of exceptional quality, efficiency, and elegance.

Sustainable thinking informs all our projects, beginning at the earliest conceptual stages and continuing right the way through to completion.

Awards:

2023 Society of Facade Engineering Awards
International Project of the Year — Mass Timber 1
UK Innovation Project of the Year — The Black & White Building

2022 Net Zero Team of the Year
Construction News Awards

2022 IStructE Award for Transformative Sustainable Design
London South Bank University

2021 Holcim Awards for Sustainable Construction
Atlassian Central — Special Commendation

2019 IStructE Award for Sustainability
La Référence de Ganthier

2019 Construction Consultancy of the Year
Construction News Awards

2018 The Queen's Award for Enterprise
International Trade

Our practice 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

01

02

03

04

"Eckersley O'Callaghan have been instrumental in the success of many of our projects...I can think of no other engineer that I would rather do more with."
Peter Bohlin
Principal
Bohlin Cywinski Jackson Architects

01
Design review meeting

02
Company educational trip to White Eagle Lodge, Hampshire

03
Company summer trip to Paris

04
Apple Marina Bay Sands, Singapore

Why Timber?

An openness to new materials has always been part of our approach at Eckersley O'Callaghan, as has an interest in developing and refining how they are used. Since we first used engineered timber to build a private house several years ago, we have continued to build on our skills and knowledge and today timber is a vital part of many of our projects on a much larger scale. We have design tools to enable the use of timber in a variety of 'engineered' forms – principally cross laminated timber (CLT), glulam, and laminated veneer lumber (LVL). Our interest in extending the capabilities of timber structures has led to the pioneering use of engineered beech in the UK working with both its strengths and limitations to bring elegance to several projects in our portfolio.

Environmental advantages

By tracking the embodied carbon of our structures, we are able to highlight to our clients the key role timber plays in their projects as we move towards carbon zero buildings and a more sustainable construction sector. With timber sequestering carbon during its life, we can use it to offset the embodied carbon of other materials used in the building, most notably steel and concrete used in foundations.

Prefabrication and programme benefits

In planning the delivery of projects from the outset, we can use the many advantages of timber construction to complete projects in ways not possible when employing more conventional construction methods. On site timber construction is fast and quiet, has reduced vehicle movements, fewer site operatives, reduced waste and improved tolerances. We can use its prefabricated nature to reduce overall construction periods to work with term schedules in education projects or to enable construction on logistically challenging sites.

Lightweight construction

Timber construction in its multiple forms offers lighter weight options compared against traditional materials such as steel, concrete or masonry. In new buildings this results in reducing foundation requirements and associated costs.

Our timber engineering skills make best use of the lightweight nature of timber to extend existing buildings further – adding stories and extending outwards. We anticipate that renovation and timber will combine with increasing frequency in the coming years, showcasing our skills in complex urban projects.

01

23
days to erect 18 bays for a 135m timber building

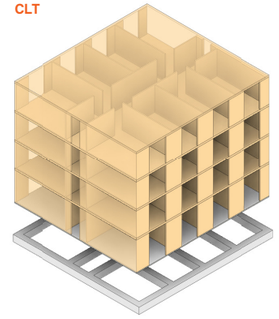
02

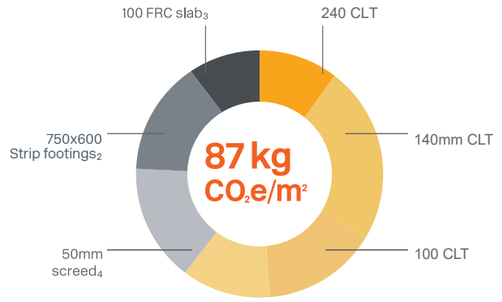
01
Construction of prefabricated timber structure of Freemen's School Swimming Pool. Detailed design to completion in just one year

02
Construction of Vitsoe Headquarters took 23 days to erect 18 bays resulting in a carbon negative building

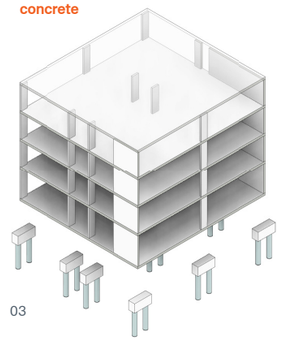
03
Carbon emissions analysis of structural systems

CLT





Reinforced concrete



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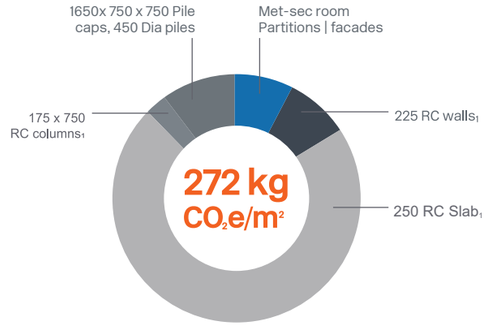


The Black and White Building,
London, UK

Our Skills

01

01
Vitsœ Headquarters Sherpa connection details

02
Visit to Weighag factory, Austria with Hawkins Brown Architect to review fabrication of Freemen's pool's timber frame

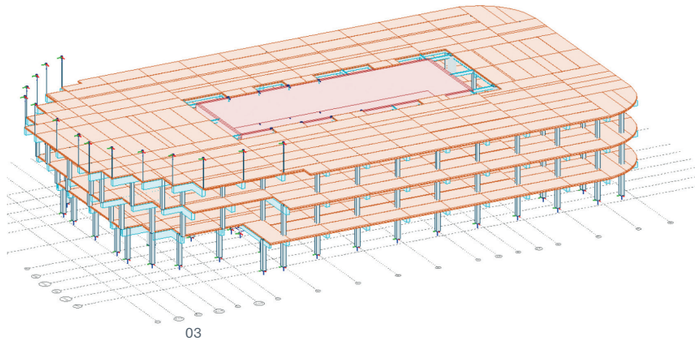
03
Strusoft model analysis of a habitat of Atlassian Central, the tallest hybrid timber tower in the world

04
Embodied carbon assessment for The Black & White Building

05
3D structural model of The Black & White Building

06
Structural analysis results showing bending moments for 2km long timber gridshell airport roof

02



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Analysis

We have the ability to carry out the structural analysis for any type of building or facade system, from the simplest to the most complex. In past projects we have successfully combined our strengths in structural analysis and design optimisation with our knowledge of the unique behaviour of timber as a construction material.

We use a wide range of software and design tools such as Strand7, Autodesk Robot, Tekla Tedds, Etabs and FEM Design by Strusoft with specific modules developed for designing mass timber elements to Eurocode 5. We have developed in-house analysis tools to quantify materials, assess embodied carbon performances and present clear data to our clients at every stage of their project. This has played an important role in early-stage decision-making, with it now possible to weigh the carbon footprint of a building against cost, programme and quality.

Detailing

The complexity of timber structures generally lies in the connection detailing. At the optimum stage of a project, our approach is to leverage the specialised knowledge of wood suppliers to design and define timber connections. This has allowed us to build a strong expertise in connections design along with a wide library of timber details in line with best practice of manufacturing and installation.

Many projects take advantage of the beauty of exposed timber, and the careful detailing of each part of the structure is vital in achieving the desired aesthetic. Our architectural appreciation, attention to detail, understanding of fabrication processes, and knowledge of static forces and material strengths, enable us to provide quality detailing as reflected in our portfolio of completed projects.

Digital design

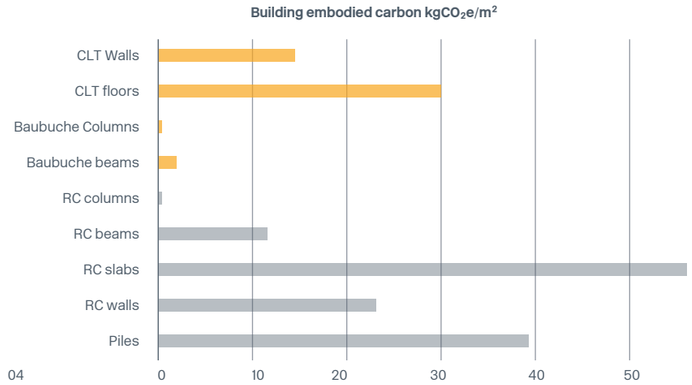
All of our projects are now executed using 3D modelling in Revit and we have delivered numerous BIM projects successfully. We combine our timber knowledge with our skills in modelling and analysis – developing designs for long span structures, grid-shell roofs and feature staircases.

Through our specialist digital design group, we have enhanced the standard software programmes by developing parametric design tools that we use to assist architects and clients in determining structurally efficient geometries. We have recently completed the design of complex-geometry timber grid-shells using Rhino and Grasshopper scripts.

Well-connected with the market

The timber industry has been gaining a lot of momentum in recent years, pushing its own limits of height, span and complexity while becoming increasingly cost efficient. We design timber structures so that they can be procured competitively. We have worked with a variety of timber suppliers and fabricators and have extensive knowledge of the timber market both in the UK and internationally.

This allows us to assist clients and design teams on procurement routes best-suited for their project. We are continuously growing our technical expertise in pace with the rapidly evolving timber industry, through our dedicated Research and Development team and a strong network of specialised professionals, including suppliers of timber products and connectors, fire engineers, and software developers etc.



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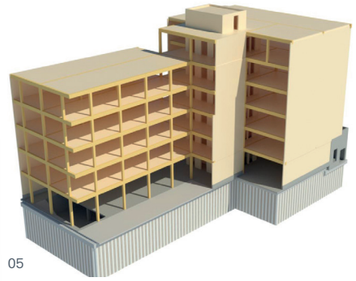

05

06

Project experience

“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

Freemen’s School
Swimming Pool,
Surrey, UK

Atlassian Central

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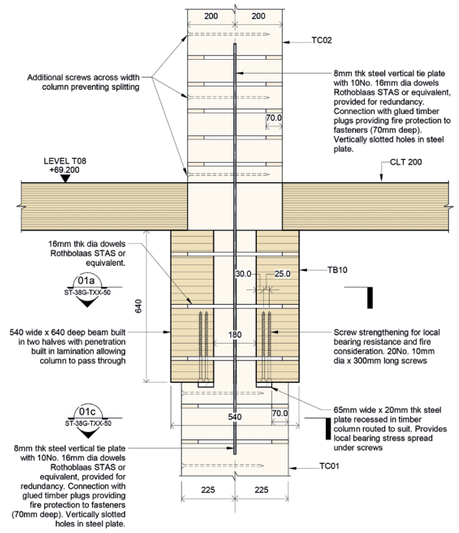
180m
world's tallest hybrid timber building

100%
renewable energy operated building

50%
less embodied carbon than traditional tall building construction



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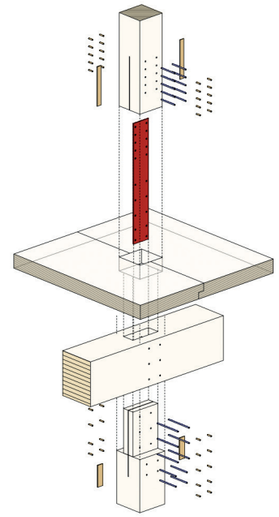


06

Location: Sydney, Australia
Client: Atlassian
Architect: SHoP | BVN
Date: Completion due 2026
Value Undisclosed
Services Provided: Structural | Facade Engineering

01
Visualisation of 40-storey high Atlassian Central

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 at the cutting edge in its application of Mass Timber Construction (MTC).

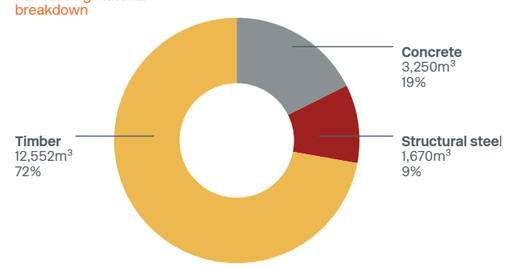
2023 CTBUH Awards — Future Project
2021 World Architectural Award — Future Office Project
2021 Holcim Awards — Special Commendation
2020 Holcim Awards for Asia Pacific — Bronze

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.
- The building will operate on 100% renewable energy from day one and include solar panels built into the facade to generate green energy on site.
- 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



The Black & White Building

01

02

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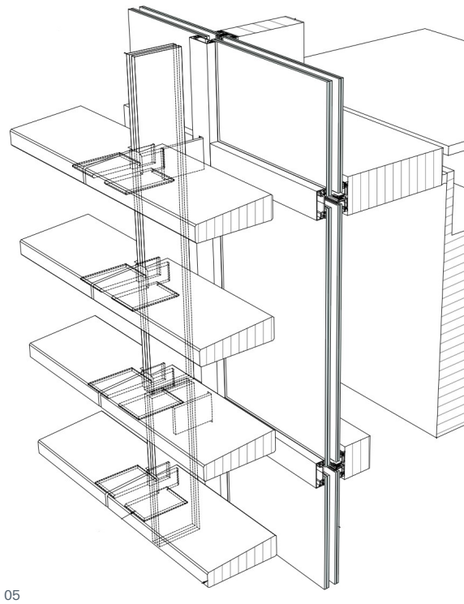
410kgCO_2e/m^2

Embodied carbon (A1-A5)
of the overall building, including
carbon sequestration



05

Location: London, UK
Client: The Office Group
Architect: Waugh Thistleton
Date: Completed 2022
Value: Undisclosed
Services Provided: Structural | Facade Engineering

2023 IStructE Awards — Shortlisted
2023 SFE Awards — UK Innovation Award
2023 Structural Timber Awards — Commercial Project of the Year
2023 Structural Timber Awards — Solid Wood Project of the Year
2023 Wood Awards — Sustainability Award
2023 Wood Awards — Commercial & Leisure Award
2023 New London Architecture Awards — The Mayor's Prize
2023 New London Architecture Awards — Workplace Award
2023 Construction News Awards — Shortlisted
2023 AJ Architects' Journal Awards — Shortlisted
2023 Dezeen Awards — Longlisted
2022 AR Future Projects Awards — Best Office
2022 WAF Awards — Shortlisted

The new Black and White Building on Rivington Street will be one of only a handful of buildings in London to feature both a timber structure and timber facade. The new six storey office features a cross laminated timber (CLT) and Laminated Veneer Lumber (LVL) frame with a timber curtain wall facade with external timber shading fins.

Eckersley O'Callaghan's Structural and Facade Engineering groups have collaborated on the project, giving an efficient, integrated design approach in-house from concept to construction.

Our structures team was tasked with achieving long spans of up to 10 metres between internal columns within a restricted floor-to-ceiling height. Enabling these long spans, we specified high performance Laminated Veneer Lumber and designed internal beams as continuous over their supports, resulting in unconventional connections between beam and column.

Lateral stability presented another challenge; the fully glazed north end of the building resulted in significant eccentricity that couldn't be dealt with solely in the CLT core walls. Steel cross bracing carefully integrated in the lightwell's facade-the only non-timber structural elements above ground-added enough stiffness to prevent excessive twisting of the building.

Our facade team has been responsible for designing the curtain walling and creating solar shading, which uses a timber fin design. The architectural intent was to partly expose the bracketry supporting the curtain wall and external shading fins, one of the key challenges was to ensure the bracketry detailing was well refined and kept minimalist to express the timber.

Every element has been assessed to ensure the best fire rating, with an advanced sprinkler system integrated that would drench the facade in the event of fire.

By using engineered timber for the building's entire superstructure – including core and staircases – we have limited the embodied carbon to just 165kgCO_2e/m^2, below the 2030 LETI target for office buildings.

01
Construction of the six-storey timber frame

02
The Black & White Building interior during construction

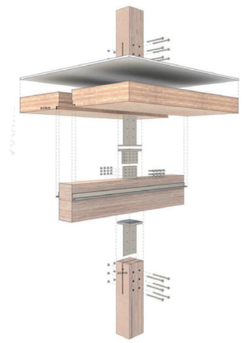
03
Timber fins facade mock-up

04
Central London's tallest mass timber office building

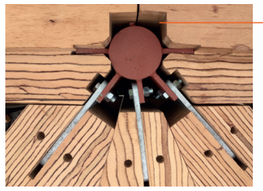
05
3D model of shading fins

06
BIM column and beam connection detail

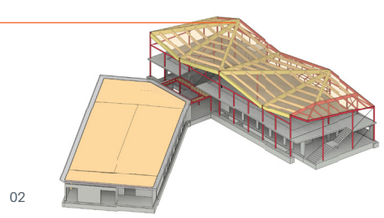
06



Promega Headquarters



01



02

Location: Southampton, UK
Client: Promega
Architect: Architecture PLB
Date: Completed 2019
Value: £6.5m
Services Provided: Structural & Civil Engineering

2021 RIBA South Award
2020 Structural Timber Award — Finalist
2020 RICS Social Impact Awards, South East, Commercial Category — Shortlisted

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International biotechnology company Promega is developing its new UK headquarters to accommodate expanding operations. Located on a vacant plot within its current home at Southampton Science Park, the new building is split into two wings; a single storey training wing incorporating laboratory and storage facilities with a green roof; and a second two-storey wing for offices, meetings rooms, catering and leisure facilities with a sculpted folded roof.

Eckersley O'Callaghan has engineered a hybrid structure in concrete, steel and timber. Concrete forms the substructure and ground floor framing. The superstructure of the office building is constructed in steel, which is exposed along the glazed facade.

The feature timber roof over the office and store buildings has been designed in BauBuche, a hardwood laminated veneer lumber (LVL), with Cross Laminated Timber (CLT) infill. The superior strength characteristics of the LVL enable efficient roof elements up to 21m in length, with column-free spaces below. The availability of the hardwood material is limited to specific suppliers, requiring expertise to manufacture and process the material.

In addition to the environmental benefits of using a timber structure, a sustainable drainage system (SuDS) has been designed to enhance biodiversity. A rill flows into a new pond before the excess water runs into a soakaway.

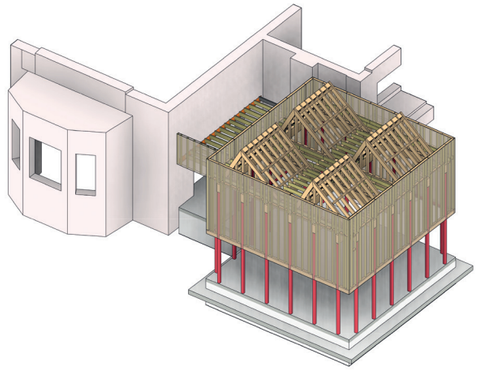
We engaged suppliers early in the design process to fully understand the benefits and limitations of working with this innovative product in delivering the client's brief.

01
Roofing timbers joining at node

02
3D model of hybrid structure in concrete, steel and timber

Thorpe Lodge

01



02

Location: London, UK
Client: Holland Park School
Architect: Atomik Architecture
Date: Completed 2022
Value: £2m
Services Provided: Structural Engineering

2022 AJ Architects' Journal Awards, School Project Category — Shortlisted

The beautiful 200 year old, Grade II-listed Thorpe Lodge in the grounds of Holland Park School in North London has just undergone a sensitive £2m transformation. The Lodge has gone from an inadequate teaching space into a stunning new art studio, school reception, and new timber gallery extension.

We designed the light touch renovation work using the existing fabric of the building wherever possible and to maximise the efficiency of the structure. We designed new openings in the load bearing brick walls to open up the spaces for teaching areas. Corroded steel in the basement was replaced.

The extension structure is a Baubuche sustainable hardwood system Laminated Veneer Lumber (LVL). The superior strength of the hard wood allows the beams to span further, rivalling steel construction but at a fraction of the embodied carbon of just 100kgCO_2e/m^2. Its strength will also allow for the school's loading criteria of a 'Fiat Cinquecento' car to be hung from the ceiling.

01
LVL Beech roof structure

02
3D structural model

Design Technology Block | St James School

Location: Surrey, UK
Client: Independent Education Trust Ltd
Architect: Squire & Partners
Date: Completed 2015
Value: Undisclosed
Services Provided: Structural Engineering

2015 Structural Timber Awards — Shortlisted
2015 FX International Design Awards, Public Sector — Shortlisted

St James School required a new Design Technology block to improve facilities and replace a collection of old storage units. The new building provides educational space for 20 students, and includes plant and storage room, and office space for two teaching staff.

Eckersley O'Callaghan carried out structural engineering services for the robust and efficient design, which takes traditional timber-framed warehouse buildings as its inspiration.

Inside, the simple aesthetic of Douglas Fir woodwork interior and craftsmanship has been emphasised through the exposed timber structure to reflect the activities carried out in the workshop. Traditional pegged mortise and tenon joints of the timber frame are counterpoised by steel hex-head fixings and sheets of birch-faced ply panels lining the walls. The structure is supported by sheathed infill timber walls, stabilised by an envelope of dark plywood cladding, of a weather-board and cover strip system.

White Eagle Lodge | New Temple Complex

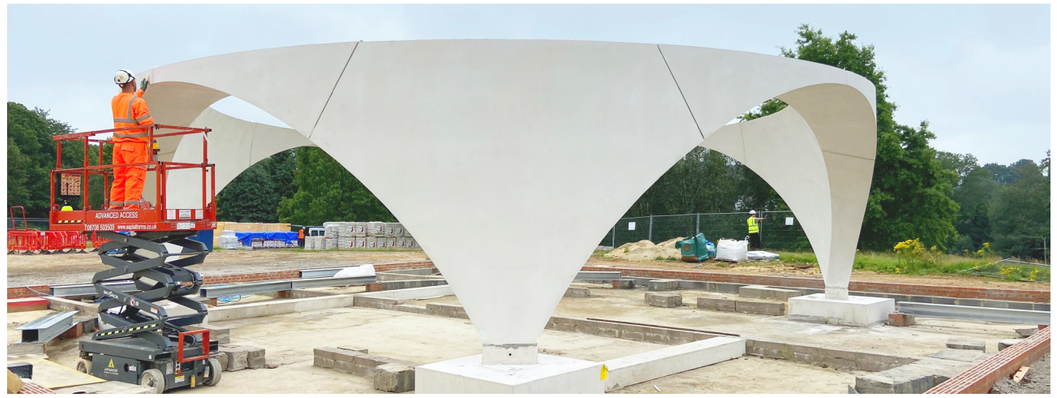
01

Location: Hampshire, UK
Client: White Eagle
Architect: James Gorst Architects
Date: Completed 2022
Value: Undisclosed
Services Provided: Structural | Civil Engineering

2023 Structural Timber Awards — Winner of Winner's
2023 Structural Timber Awards — Contractor of the Year
2023 Structural Timber Awards — Low Energy Project of the Year
2023 Wood Awards — Gold Award
2023 Wood Awards — Education and Public Sector Award
2023 AJ Architects' Journal Awards — Design of the Year Award
2023 AJ Architects' Journal Awards — Community and Faith Project Award
2023 Dezeen Awards — Shortlisted in the Civic Project category

After water irreparably damaged White Eagle lodge, the spiritual body has embarked on building a new home. The new temple design will embody the ethos of simplicity and beauty; using architecture as a sacred expression of the divine. Sacred geometry and harmonious mathematical ratios are reflected in the inner temple proportions, carefully positioned window openings connect to the natural landscape beyond and the heavens above.

This beautiful new sustainable structure has been designed by Eckersley O'Callaghan using a Larch glulam timber frame lantern structure with a precast pendentive arched temple design.



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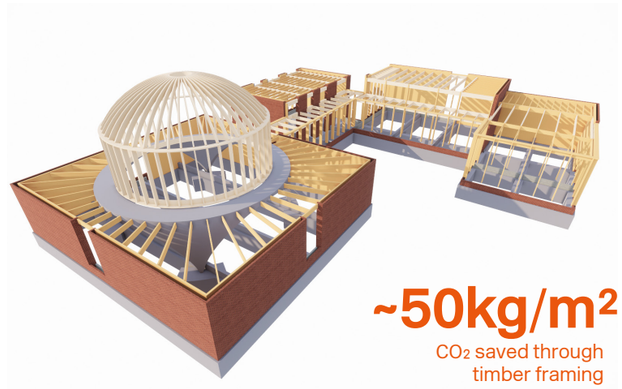

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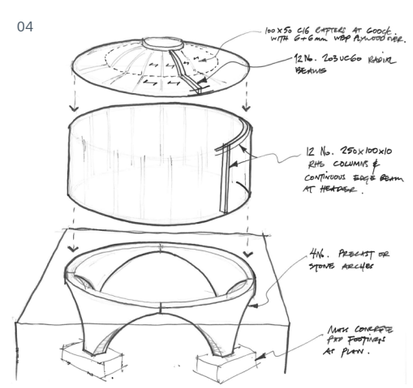


04

To ensure its sustainability, we carried out a full analysis using our in-house Embodied Carbon Calculator to justify implementing the timber frame option. Through this we were able to give a saving of ~50kg/m² of carbon dioxide when compared to the alternative load bearing masonry and steel-framed options. A sub-floor cooling labyrinth below the concrete floor is used to provide cost effective cooling strategy.

To help White Eagle understand the spatial context of the structural solutions we used our new virtual reality software to explore the space during the design process.

The design was subject to a strict budget. To minimise cost and save time on the programme, we have used plywood timber cassettes - pre-assembled insulated panels - for the majority of the roof structures. We also completed a finite element analysis of the concrete to refine the reinforcement detailing.

A reduced reinforcing bar spacing ensured minimum potential for surface cracking and imperfections in the concrete, and relatively small 12mm-diameter bars were used to limit the carbon footprint of the units. Using our EOC ECO² Embodied Carbon Calculator, we established the final embodied carbon score of the structure, 265kg embodied CO_2/m^2, which for a single-storey building is low and environmentally had always been a key driver for the client group.

The assembly on-site was carefully orchestrated to bring the units together and lock each into alignment. The weight and scale of the units forced these pieces to be some of the first deliverables during the construction programme; once installed, the remainder of the building enveloped these obelisk structural elements within the lightweight timber frame construction. The end result is a fine testament to the co-ordination and communication across the design and site delivery teams.

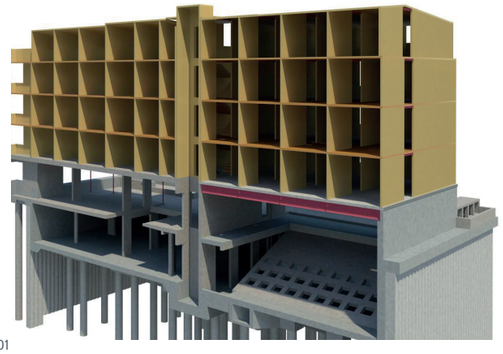
01
Complete Temple exterior and interior view

02
Site installation of precast units

03
3D model of structure

04
Initial sketches of the temple design

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

2019 RIBA South Awards — Shortlisted
2019 Offsite Construction Awards, Commercial Project of the Year — Shortlisted
2018 Structural Timber Awards — 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 structural model

02
Installation of CLT walls

03
Bonavero Institute of Human Rights

Charlotte Road

01

02

03

Location: London, UK
Client: Private
Architect: MPA Architects
Date: Completed 2015
Value: Undisclosed
Services Provided: Structural Engineering

Eckersley O'Callaghan was tasked with the structural design of a two storey prefabricated roof top extension for a private residence in central London using cross laminated timber (CLT) sat on a grillage of steel beams.

The CLT was chosen for its speed of installation and high strength to weight ratio to allow larger spans and more flexible use of space internally. It was preferred to SIP panels or traditional timber joist infill to minimise depth of structure. The additional advantages of using CLT are its low embodied energy and volume of carbon sequestered within the life cycle of the building.

The main challenge for the project was to ensure the additional load was directed onto the strong points of the building below. This was achieved by means of the steel grillage sat on carefully positioned reinforced concrete padstones within the party walls and piers below.

The central London location imposed constraints in terms of road access for craneage and over sailing rights. For this reason the crane was installed on the foundation for the proposed lift within the building courtyard.

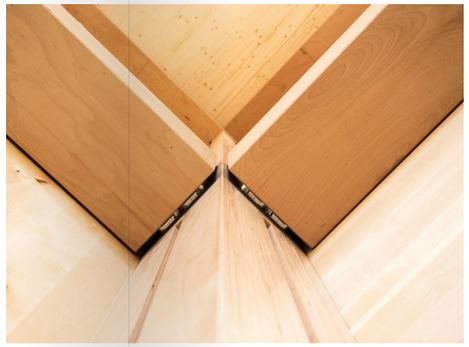
01 | 02 | 03
Installation of prefabricated CLT rooftop extension

Vitsœ Headquarters

01

02

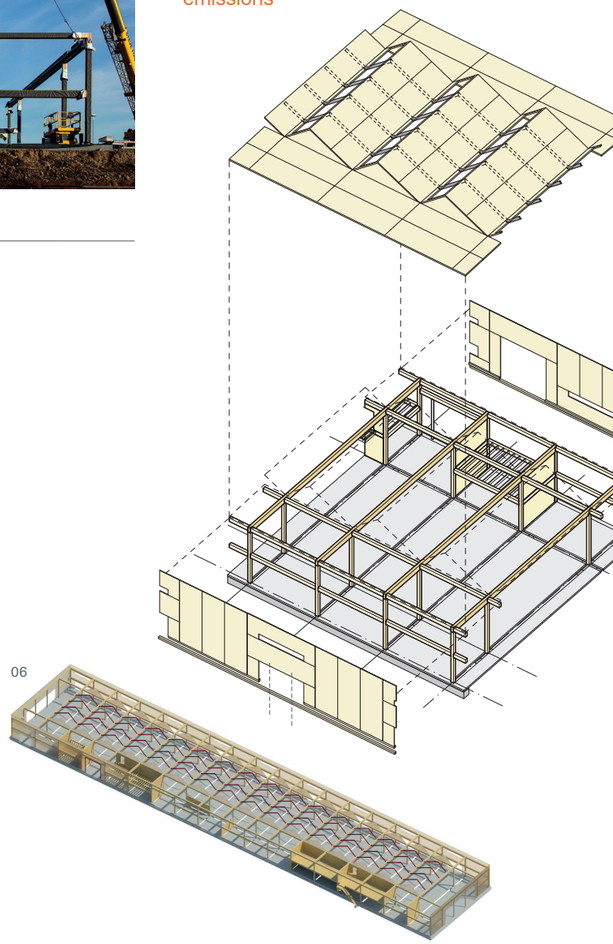
03



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
Vitsœ 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 135m in length, 25m in width and 6m in height, the structure is engineered to be modular, flexible, adaptable, and self-explanatory, with innovative material use.

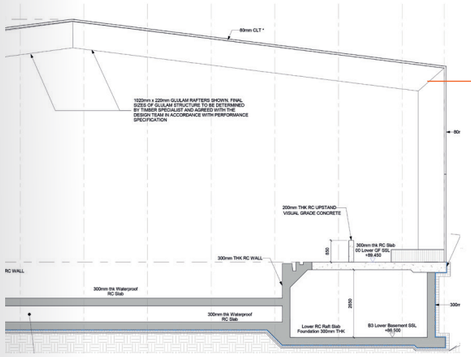
The building features a timber frame, comprised of hardwood, laminated veneered lumber (LVL) members and cross-laminated timber (CLT) walls for both the envelope and internal shear walls. It's the first building in the UK to be made almost entirely from a newly developed Beech LVL timber material. The 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 Vitsœ's own products. This has been achieved with a flexible system building that can be easily altered, dismantled and replicated anywhere in the world.

Swimming Pool | City of London Freemen's School

01



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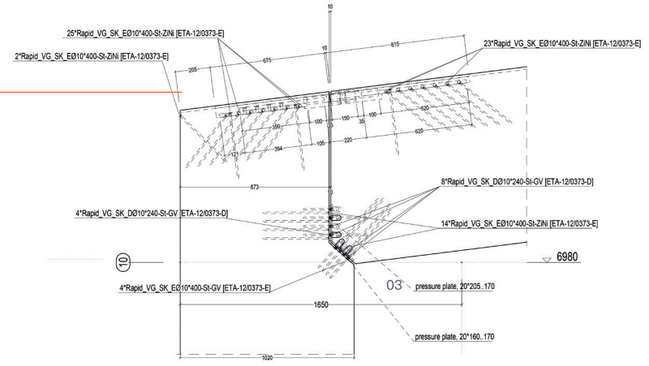
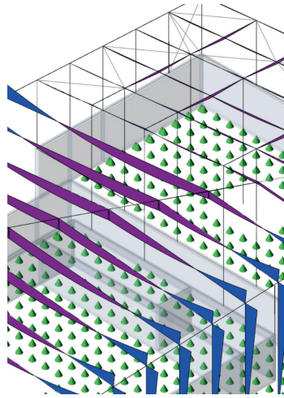


03

04

05



06

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

2018 RIBA South East Awards — Client of the Year Award
2018 RIBA Awards — National Award
2018 Structural Timber Awards — Education Project of the Year Award
2018 RIBA South East Awards — Regional Award
2018 RIBA South East Awards — Sustainability Award
2018 Wood Awards — Structural Award
2018 Wood Awards — Education & Public Sector Award

01
Freemen's School Swimming Pool

02
Structural plan

03
Hidden eaves connection detail

04
CLT structure assembly

05
Long span portal frames in glulam timber

06
Portal frame-bending movements

07
3D BIM model of structure

Eckersley O'Callaghan provided structural engineering services for a new six-lane, 25-metre competition swimming pool for City of London Freemen's School, replacing the original pool which was destroyed by a fire in 2014. This new 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 our 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.

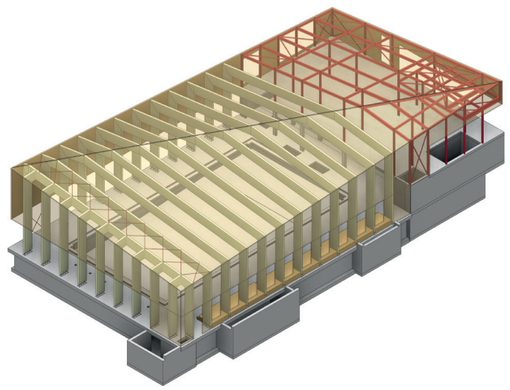
The site is located in an area of chalk which is liable to corrosion over time – we designed a foundation solution to minimise this risk while carrying the weight of the superstructure. We were also responsible for the detailed design of all reinforced concrete and steel elements.

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

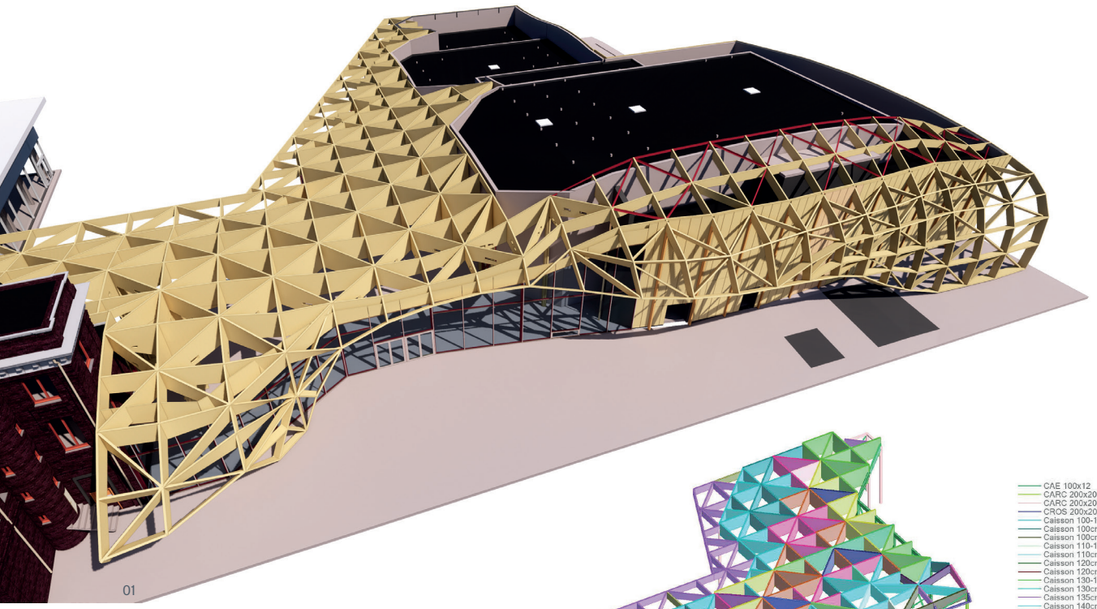
Prefabricated off-site, the structure was assembled on-site in just over three weeks. From detailed design to completion, the project took only one year.

90t
CO_2 sequestered from 675m³ timber used

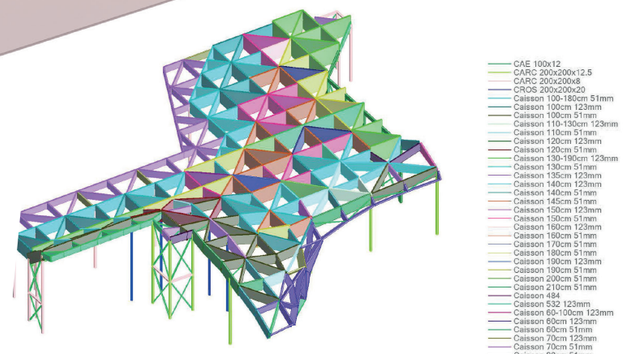
07



Trinum | Médiathèque for Digital Culture



01



02

Location: Lomme, France
Client: Ville de Lille
Architect: Jakob + Macfarlane
Date: Completed 2021
Value: £6m
Services Provided : Structural | Facade Engineering

01
3D structural model of diagrid timber roof

02
Structural optimisation analysis of beam sizing

03
Architectural visualisation of Trinum

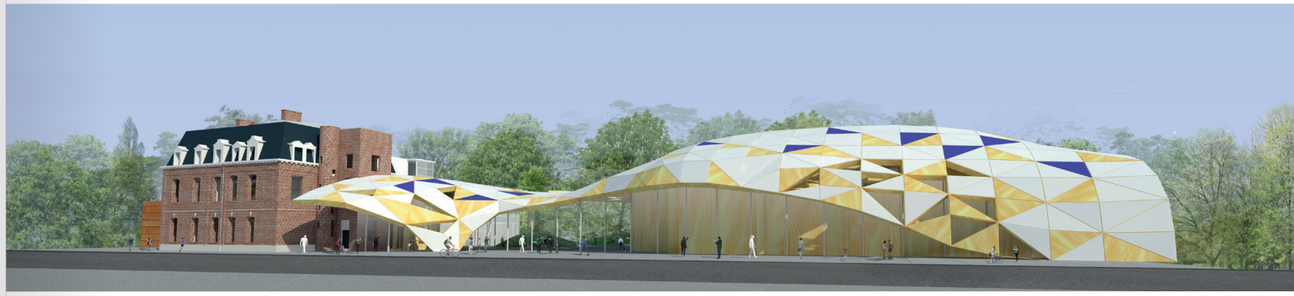
04
Render of 1000 standing capacity digital visualisation hall, snack bar, community centre

05
Structural analysis of flow of raindrop water drainage

The new Trinum centre has a strikingly futuristic design, with its digitally-designed sweeping freeform diagrid roof, housing a new living lab, digital visualisation room, snack bar, community centre, offices, and a multipurpose hall with capacity for 500 people seated or 1000 standing.

Eckersley O'Callaghan undertook the design for the new 4400m^2 roof and its supporting structure, the curtain walls, facades and metal/timber cladding.

The timber roof comprises beams of varying depths, some efficiently laser cut from solid 123mm-thick laminated veneer lumber (LVL) panels, while others are made up of two vertical panels 51mm thick sandwiching a 21mm-wide LVL lamella. Mechanical and electrical services will be co-ordinated and embedded to create a stunning expressed structure internally. The roof will be clad in a rain screen facade made up of a mixture of timber and aluminium panels of blue or white.

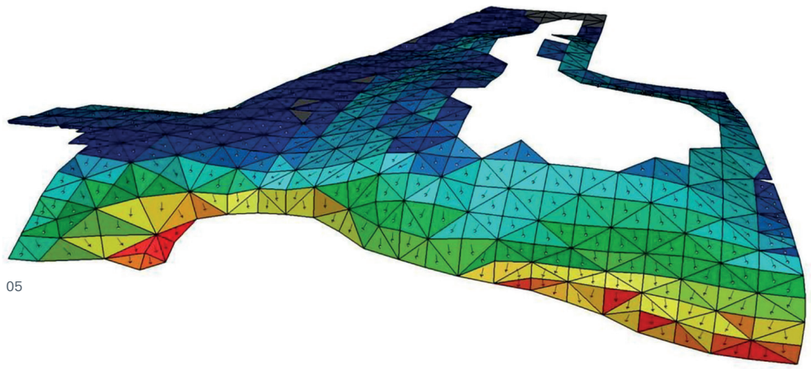


03

04

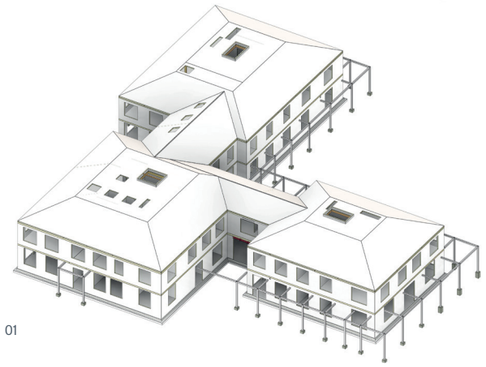
Digital design techniques were employed to develop the final detailed member geometry for the roof structure based on the architect's reference model. The roof has over 1,000 unique tapering timber beams, their geometry responding to the structural and architectural requirements of the spaces below. To transfer the geometry from the parametric model to the Revit BIM model, bespoke scripts were developed, allowing a seamless flow of information between the two different software and no data loss between models.

460m^3
of LVL timber to form the freeform diagrid roof



05

Sevenoaks Boarding House



01

02

Location: Kent, UK
Client: Sevenoaks School
Architect: Tim Ronalds Architects
Date: Completed 2020
Value: Undisclosed
Services Provided: Structural | Civil Engineering

2022 RIBA South East Award
2022 RIBA National Award

This three-storey boarding house provides bedrooms and communal space for over 60 boarding pupils at Sevenoaks School, and two self-contained duplex apartments for resident staff.

The project was delivered to an ambitious programme so that it could open in time for the new academic year. Speed of construction was a significant consideration in the development of the design and project procurement.

The superstructure of the building is made from cross-laminated timber (CLT), enabling the full superstructure to be erected on site in just three months. The first CLT panels were required to arrive on site just nine weeks after the main works started; appointment of the CLT contractor with a pre-construction services agreement allowed final fabrication drawings to be developed in advance of the appointment of the main contract to meet this deadline.

The thin reinforced concrete raft foundation slab forms the base to the CLT superstructure and accommodates local variations in ground conditions across the site. Located within a groundwater source protection zone, the site's below-ground drainage and disposal of rainwater was developed in close co-ordination with the Environment Agency.

01
3D structural model
of boarding house

02
3D structural model
of duplex apartments

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Swimming Pool,
Surrey, UK

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