H\B:ERT

Hawkins\Brown: Emission Reduction Tool

Hawkins\
Brown

UCL

Welcome to Hawkins\Brown

We are architects\designers\planners\thinkers\makers\researchers\problem-solvers\visualisers\communicators\deliverers\collaborators and, most of all, good listeners.

Hawkins\Brown is a modern British architectural practice with an award-winning approach to sustainable design. It goes hand in hand with achieving long term value for our clients and the environment. We believe that an integrated and collaborative design process is vital to achieving a truly efficient and sustainable building.

Sectors
Education
Workplace
Residential
Infrastructure
Civic, community & culture

Services
Architecture
Interior design
Urban design
Masterplanning
Working with artists
Sustainability
Research

H\B:ERT

Can easy visualisation of embodied carbon encourage the use of this data as an iterative design tool to reduce carbon emissions?

The built environment is one of the biggest contributors to carbon emissions worldwide. Calculating embodied carbon values and evaluating their impact on buildings' lifecycle carbon footprint has historically been a complex task carried out by specialist mostly. Hawkins\Brown has worked in partnership with the UCL Institute for Environmental Design and Engineering (IEDE), through their Engineering Doctorate program, to create the Hawkins\Brown Emission Reduction Tool - H\B:ERT.

H\B:ERT has been developed as part of an Engineering Doctorate program, titled 'Refurbished or Replace - the life cycle performance of existing buildings and their replacements', by Yair Schwartz, UCL.

H\B:ERT is an easy-to-use Revit-based tool that enables design teams to quickly analyse and clearly visualise the embodied carbon emissions of different building components and construction materials options at any time during the design process. This allows an easy yet robust comparison between different elemental design options and sets the grounds for a complete life cycle carbon footprint analysis.

The tool and a 'how-to guide' will be available to access freely through the Hawkins\Brown website.

hawkinsbrown.com

Methodology
The birth of H\B:ERT

5 years ago Hawkins\Brown and UCL agreed to co-fund a research project to enable an improved visualization of embodied carbon and the impact of this on the whole life carbon of a project. This would facilitate a better level of understanding and discussion around the retention, refurbishment and creative re-use of existing buildings as a contribution to the reduction of overall emissions.

At the time, Hawkins\Brown were working on a portfolio of prestigious creative re-use projects (opposite) but felt that the embodied carbon saved was not recognised. While tools are available to measure predicted annual energy use and therefore operational carbon, one of the challenges has been calculating the embodied carbon within a proposal.

Initially to progress the case study research, each proposal was measured manually. However, developments in 3D modelling packages during the length of the research period allowed the development of a digital tool - H\B:ERT.

Park Hill, Sheffield
Hawkins\Brown won a competition in 2004, with Urban Splash and SEW, for the redevelopment of the Grade II* Listed estate. The project has gone on to become one of the most high profile heritage and regeneration schemes of the last decade and was shortlisted for the Stirling Prize.

Sustainability is embedded in the Park Hill project – to keep, make good and bolster the best parts of the original scheme, including the original concrete frame. The embodied energy in the concrete frame is equivalent to three weeks' energy output from a power station.

3219 ton/CO_2e
total embodied carbon (in frame) savings

90 kg CO_2e/m^2
Embodied carbon savings per m^2 of floor area

Student Centre, London South Bank University

The new Student's Centre at London South Bank University provides social and pastoral student support. The design approach was to transform an undercroft car park and first floor refectory space. The creative re-use of this existing structure saved a significant amount of embodied carbon. However, despite this approach we found planning negotiations difficult. We felt an appreciation of the contribution that the re-use of existing structure made to the overall sustainable design strategy was not fully understood due to the lack of explanatory data and visuals.

349 ton CO_2e

total embodied carbon (in frame) savings

175 kg CO_2e/m^2

Embodied carbon savings per m^2 of floor area

Bartlett School of Architecture, UCL

The Bartlett School of Architecture is one of the best in the world. Its home, originally built in the 1970s, however, was failing to provide the quality or quantity of space necessary for the school to flourish. Our design doubles the amount of space available, while retaining the building's existing structure. Retention was proposed for several reasons. There were advantages for both cost and programme. It eased planning negotiations in regards scale. In addition, the frame held a significant volume of embodied carbon; something we felt was not properly recognised during the design process.

440 ton CO_2e

total embodied carbon (in frame) savings

80 kg CO_2e/m^2

Embodied carbon savings per m^2 of floor area

Methodology

What is H\B:ERT?

H\B:ERT works by measuring the volume of all materials tagged in the Revit model. It then applies embodied carbon data to that material, broken down into life cycle stages (product, construction, use stage and end of life) in line with BS EN 15978:2011. The tool aligns with the recent RICS and RIBA guidance and currently uses the University of Bath ICE database 2011 by default. However, the tool can work with alternative data where available.

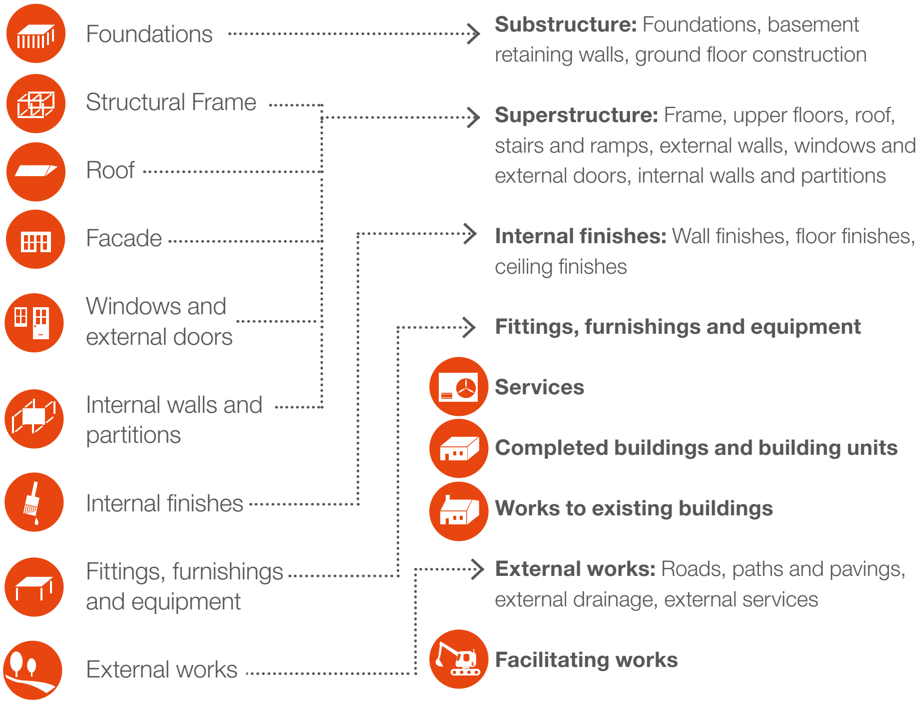
The use and development of H\B:ERT is in it's infancy. This document is a compilation of the studies that have been done to date and the lessons learnt from carrying out that analysis.

The direction of the current guidance available pushes the principle of carrying out whole building analyses. While this is useful, it can only be carried out once the design is finalised and sufficient information is available to carry out a full calculation. We have therefore also found elemental analysis at an early design stage to be a very powerful use of this tool.

Materials are coloured according to the chart opposite.

- HBA_Aluminum
- HBA_Aluminum (recycled)
- HBA_Asphalt (Road and Pavement)
- HBA_Asphalt and Bitumen(road paving)
- HBA_Bitumen
- HBA_Brass
- HBA_Brick
- HBA_Carpet
- HBA_Ceramic Tiles
- HBA_Concrete (autoclaved aerated)
- HBA_Concrete (Reinforced)
- HBA_Concrete - Bedding Material
- HBA_Concrete - Screed
- HBA_Concrete Block (hollow)
- HBA_Concrete Block
- HBA_Concrete - Cast In Situ
- HBA_Concrete Precast
- HBA_Concrete High GBBS
- HBA_Copper
- HBA_Fiber Cement
- HBA_Glass
- HBA_Gravel
- HBA_Gypsum Plasterboard
- HBA_Insulation - Mineral Wool
- HBA_Insulation - Polystyrene, Expanded Insulation
- HBA_Insulation - Polyurethane
- HBA_Insulation - Rock Wool
- HBA_Marble
- HBA_Plaster
- HBA_Plasterboard with timber studs (every 0.4 m)
- HBA_Plasterboard with timber studs (every 0.6 m)
- HBA_Plasterboard with aluminium studs (every 0.4 m)
- HBA_Plasterboard with aluminium studs (every 0.6 m)
- HBA_PVC
- HBA_Sand
- HBA_Slate
- HBA_Soil
- HBA_Steel
- HBA_Steel Stainless
- HBA_Stone
- HBA_Stone Granite
- HBA_Stone Limestone
- HBA_Stone Sandstone
- HBA_Vinyl Flooring
- HBA_Wood - Glulam
- HBA_Wood - Hardboard
- HBA_Wood - Laminated Veneer
- HBA_Wood - MDF
- HBA_Wood - OSB
- HBA_Wood - Plywood
- HBA_Wood - Softwood
- HBA_Zinc
- Existing

BS EN 15978:2011 breaks down embodied carbon data into the following elements that are within the control of the design team:



From reviewing our whole building results carried out at RIBA Stages 4 and 5, we found that certain elements have more effect on the final result than others. This allowed us to focus elemental studies at earlier design stages RIBA 2 and 3 to compare material options. This document is structured into sections covering the elemental analyses currently undertaken and lessons learnt:

- Whole buildings
- Superstructure - foundations, frame, upper floors, roof
- Superstructure - facade
- Interior finishes

The categories are a slightly simplified version of the categories specified in BS EN 15978:2011 as shown in the diagram opposite.

Whole buildings


SWIMMING POOL

Freemen's School Swimming Pool

Swimming amongst the trees

Location: Ashtead, Surrey, UK
Sector: Education
Service: Architecture, interior design
Scope: New build
Size: 1,750 sq m
Sustainability: BREEAM Very Good, RIBA Sustainability Award 2018
Status: Complete

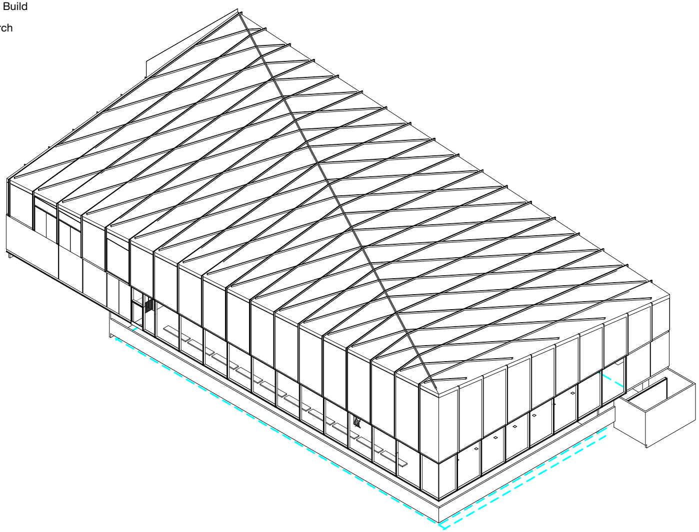
The swimming pool sits gently within its context. The structural frame was fabricated off-site and erected in just over 3 weeks. The main pool structure comprises a glulam portal frame, braced with CLT panels. This proved to be a fast, efficient, carbon neutral method of construction, providing both a structure and internal finish to deal with the challenges of a pool environment. A full embodied carbon analysis of this project was carried out to test the H\B:ERT tool development and test the effect of changing parts of the structure to steel. Full building analyses allowed us to understand the elements that affect the overall embodied carbon for a project in more detail.

\The School is overwhelmed by the beauty and quality of the new swimming pool – it is a fantastic new asset for our School and local community

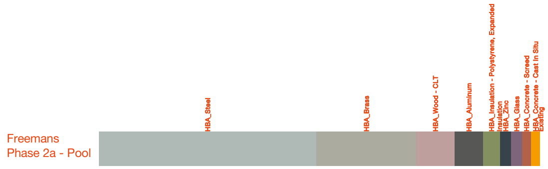
Roland Martin Headmaster, The City of London Freemen's School

Freemens Phase 2a - Pool

Date: 6.9.2018
RIBA Workstage: 4
Location: Ashtead, Surrey
Floor Area: 1000
Type: New Build
Sector: Arch
Stage:



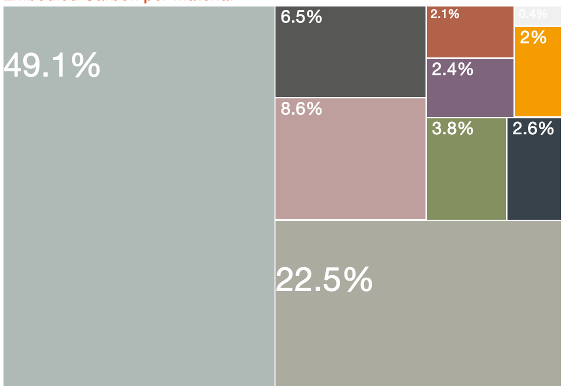
Total Embodied Carbon



Total Embodied Carbon: 1851 **ton CO_2e**

Average per m² of Floor Area: 1058 **kg CO_2e/m^2**

Embodied Carbon per Material



Rev	Description	Date

Scale @ A3: 1 : 1	Date: 09/06/18	Job Number: 1449	Project: Freemans Phase 2a - Pool, Ashtead, Surrey
Drawn By: Author	Checked By: Checker	Status:	
Drawing No.: HBERT	Rev:	Purpose of Issue:	Drawing: EC Evaluation

H\B:ERT
HB Carbon Emissions Reduction Toolkit

Doctor's Surgery

A healthy building to foster wellbeing

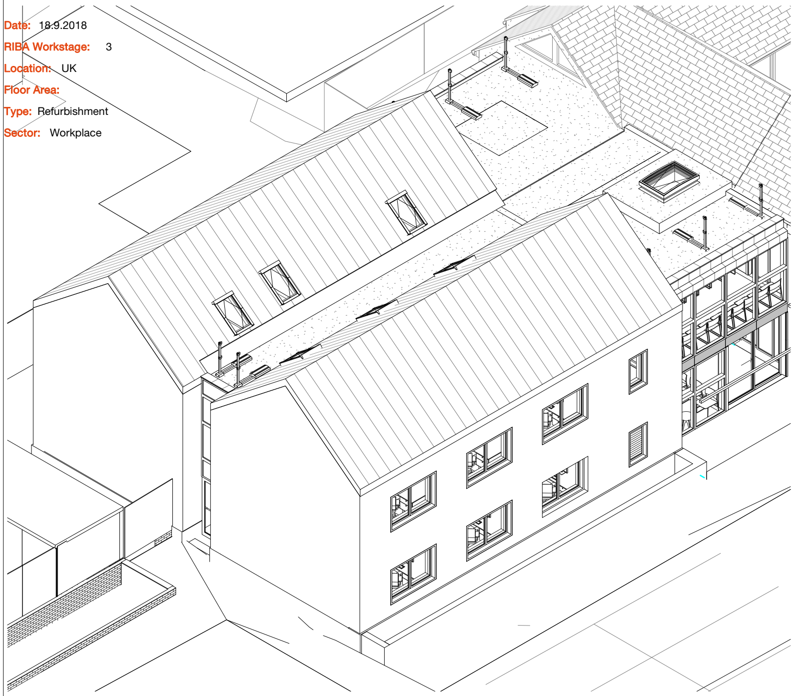
Location: UK
Sector: Workplace, civic, community & culture
Service: Architecture, interior design
Scope: Retrofit, new build, extension, restoration, interiors
Size: 480 sq m
Sustainability: BREEAM Very Good
Status: Concept

The expansion of an existing Surgery building is required to provide accessible, up to date, local facilities in line with current NHS guidelines. The new build extension responds sensitively to the conservation area and complements the existing building.

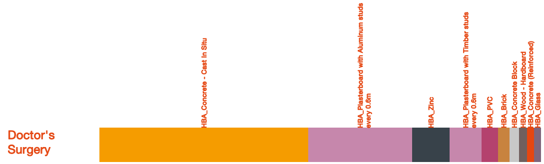
Efficiency, future proofing and sustainability are all key drivers for the project. A full embodied carbon analysis using H\B:ERT allowed the interrogation of the relationship between the new build and refurbishment elements of the project. This balance was optimised while ensuring the future flexibility and low ongoing maintenance of the surgery building.

Doctor's Surgery

Date: 18.9.2018
RIBA Workstage: 3
Location: UK
Floor Area:
Type: Refurbishment
Sector: Workplace



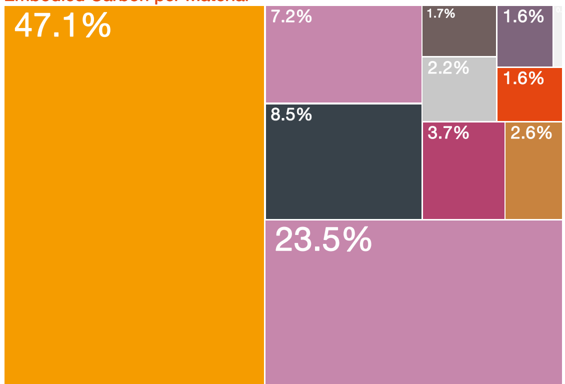
Total Embodied Carbon



Total Embodied Carbon: 1284 **ton CO_2e**

Average per m² of Floor Area: 2674 **kg CO_2e/m²**

Embodied Carbon per Material

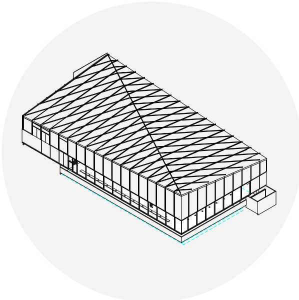


Rev	Description	Date

Scale @ A3: 1 : 1	Date: 09/18/18	Job Number: 18032	Project: Central Surgery Bell Street Sawbridgeworth
Drawn By: Author	Checked By: Checker	Status:	
Drawing No.: HBERT	Rev:	Purpose of Issue:	Drawing: EC Evaluation

H\B:ERT
HB Carbon Emissions Reduction Toolkit

Whole buildings
Lessons learnt



Freemen's School Swimming Pool

1 057 kg/CO_2e/m²
average embodied carbon per m² of floor area

Doctor's Surgery

2 674 kg/CO_2e/m²
average embodied carbon per m² of floor area

Freemen's School Swimming Pool

- The large difference between steel and CLT structures can be clearly seen as the steel structure is used in 25% of the building, but accounts for nearly 50% of the embodied carbon.

- The brass cladding is the second largest value and aluminium support framing is also a large contributor.

- In general metals have the highest embodied carbon values.

Doctor's Surgery

- Due to the use of an insitu-concrete structural frame this project contains over double the embodied carbon per m^2 despite re-using the existing building.

- In general the concrete structure is approximately 50% of the total figure. Plasterboard with aluminium support framing is the second largest contributor; on this project internal partitioning has a greater impact than the brick cladding

- An understanding of the level of detail modelled at is required to interpret the data correctly. For example, the thickness of metal surfaces and factoring in an allowance for secondary supports rather than measuring the entire zone creates more accurate results.

Structural frames

Urban Sciences Building

The living laboratory

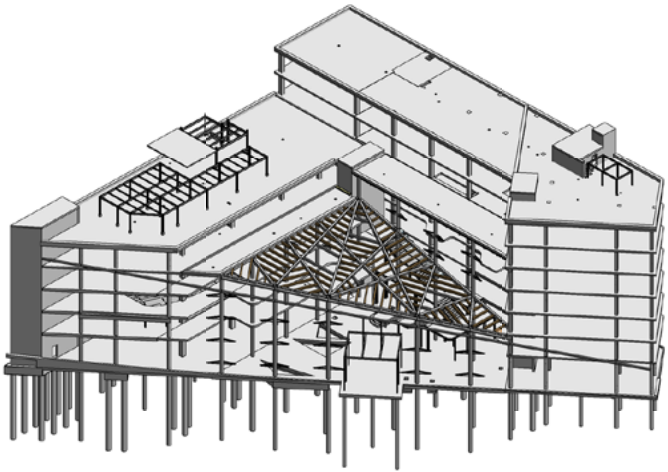
Location: Newcastle, UK
Client: Newcastle University
Sector: Education
Service: Architecture, interior design, sustainability, research
Scope: New build
Size: 12,800 sq m

Sustainability: BREEAM Excellent, Bespoke Framework, Blueprint Award 2018 for Best Sustainable Project (shortlisted), Lord Mayor's Design Award 2018 for Sustainability
Status: Complete

Newcastle University's Urban Sciences Building is a 'Living Laboratory', a test bed for research ideas relevant to urban sustainability, experiments and industry partner collaboration. The University were keen for the building to be as sustainable as possible and many of the materials specified were renewable and self-finishing including the hybrid timber and steel forum roof. The main structure was an insitu concrete slab to achieve a flat slab for services coordination; post tensioned where larger spans were required. The analysis shows the difference between the two systems.

Urban Sciences Building

Date: 7.9.2018
RIBA Workstage: 4
Location: Newcastle, UK
Floor Area: 12800
Type: New Build
Sector: Arch
Stage:

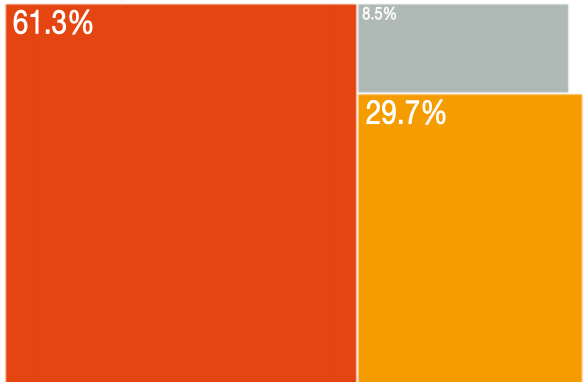


Total Embodied Carbon

Total Embodied Carbon: 3569 **ton CO_2e**

Average per m² of Floor Area: 286 **kg CO_2e/m^2**

Embodied Carbon per Material



Rev	Description	Date

Scale @ A3: 1 : 1	Date: 09/07/18	Job Number: 032953	Project: NEWCASTLE UNIVERSITY Enter address here
Drawn By: Author	Checked By: Checker	Status:	
Drawing No.: HBERT	Rev:	Purpose of Issue:	Drawing: EC Evaluation

H\B:ERT
HB Carbon Emissions Reduction Toolkit

Biomedical Research Building

Spaces to promote collaboration

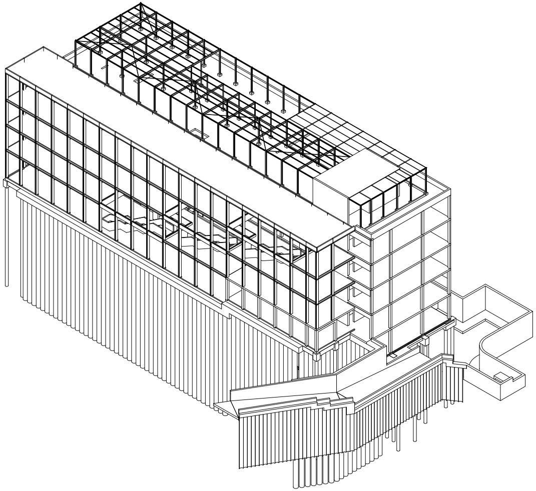
Location: Warwickshire, UK
Sector: Education
Service: Architecture, interior design
Scope: New build
Brief: Multi-disciplinary biomedical laboratories, write-up spaces, cellular offices, seminar and meeting rooms, lecture theatre, café, social spaces, collaboration spaces
Size: 6,800 sq m
Sustainability: BREEAM Excellent
Status: Construction

The design provides a state-of-the-art environment that supports and fosters interdisciplinary research. Expressing the collaborative aspiration for the building and celebrating the natural context is a key part of the concept through a different material language.

The structure in collaboration areas is timber, reflecting the landscaped context beyond. In the lab areas a concrete structure is used to achieve the spans, vibration criteria and services coordination. The difference in embodied carbon between the contrasting structural systems can be seen within the analysis.

Biomedical Research Building

Date: 18.9.2018
RIBA Workstage: 2
Location: UK
Floor Area:
Type: New Build
Sector: Education

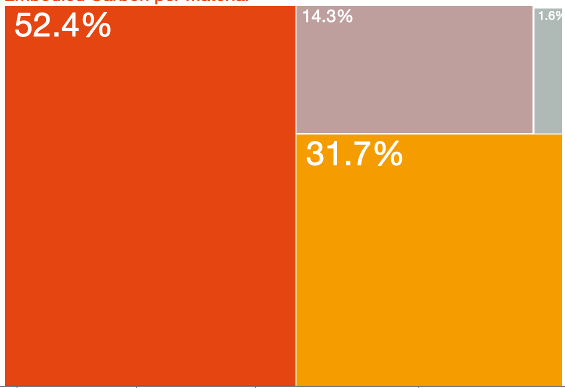


Total Embodied Carbon

Total Embodied Carbon 2461 **ton CO_2e**

Average per m² of Floor Area 362 **kg CO_2e/m²**

Embodied Carbon per Material



Rev	Description	Date

Scale @ A3 1 : 1	Date 09/18/18	Job Number XXXX	Project UNIVERSITY OF WARWICK IBRB Enter address here	H\B:ERT HB Carbon Emissions Reduction Toolkit
Drawn By Author	Checked By Checker	Status		
Drawing No. HBERT	Rev	Purpose of Issue	Drawing EC Evaluation	

Dementia Research Institute

Neuroscience research space

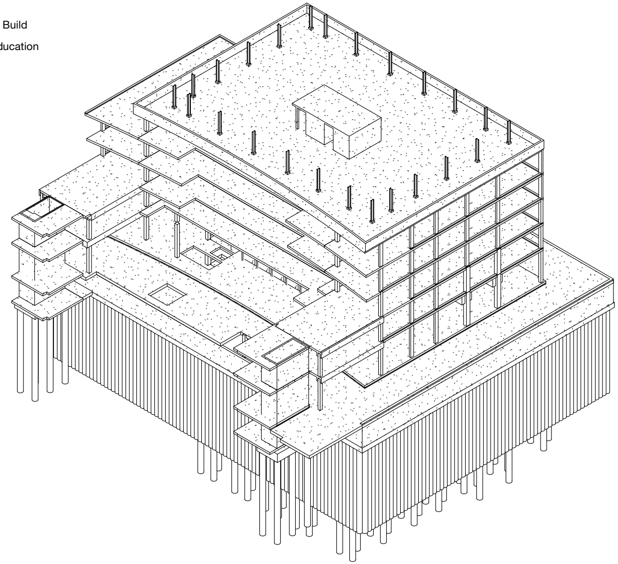
Location: London, UK
Sector: Education, workplace
Service: Architecture
Scope: Refurbishment, new build
Brief: Offices, teaching spaces, meeting rooms, wet laboratories, dry laboratories, storage, write-up spaces
Size: 17,200 sq m
Sustainability: BREEAM Excellent
Status: Concept

The project involves the creation of an inter-disciplinary research facility fostering collaboration. It is on a tight urban site. This is reflected by the requirement for a deep basement to exploit the site footprint and the density of piles required to achieve the strict vibration criteria. An insitu-concrete structural frame has been chosen for services coordination and reduction in vibration response factor.

The analysis shows the impact of the structural frame decision on the embodied carbon figures. It can also be shown that embodied carbon data has a strong correlation with cost. For example the deep basement and dense piles used here are necessary to meet the brief but are both costly and high in embodied carbon.

Dementia Research Institute

Date: 18.9.2018
RIBA Workstage: 2
Location: London, UK
Floor Area:
Type: New Build
Sector: Education



Total Embodied Carbon

Dementia Research Institute

Total Embodied Carbon: 4329 **ton CO_2e**

Average per m² of Floor Area: 252 **kg CO_2e/m^2**

Embodied Carbon per Material

Rev	Description	Date

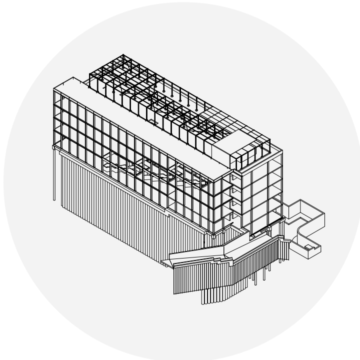
Scale @ A3: 1 : 1	Date: 09/18/18	Job Number: 162#######	Project: IoN/DRI Enter address here
Drawn By: Author	Checked By: Checker	Status	
Drawing No.: HBERT	Rev	Purpose of Issue	Drawing: EC Evaluation

H\B:ERT
HB Carbon Emissions Reduction Toolkit

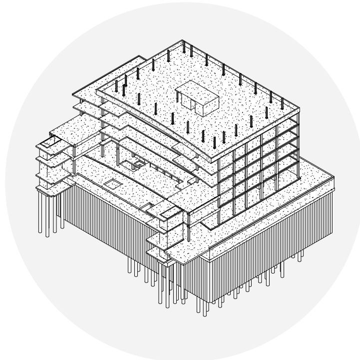
Structural frames

Lessons learnt

Urban Sciences Building



Biomedical Research Building

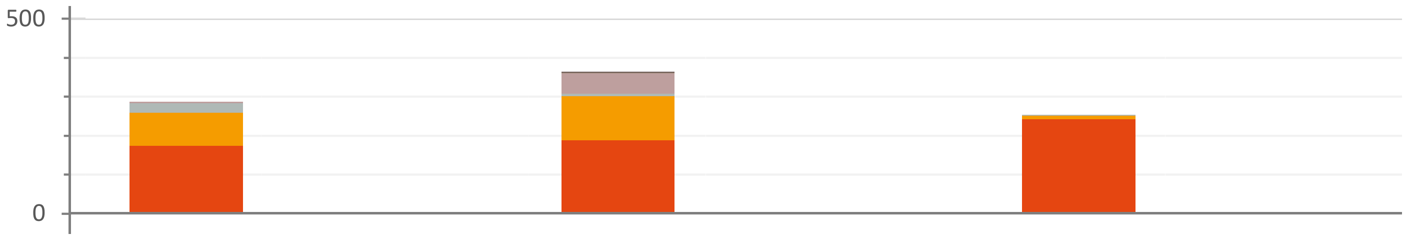


Dementia Research Institute

285 kg/CO_2e/m^2
average embodied carbon per m^2 of floor area

361 kg/CO_2e/m^2
average embodied carbon per m^2 of floor area

252 kg/CO_2e/m^2
average embodied carbon per m^2 of floor area



General findings

- Foundation design has the largest single impact on the embodied carbon within the design.

- The density of piles required to retain the sloping ground in the Biomedical Research Building mean it has the highest comparative value, despite having an extensive timber structure.

- The piles on the Biomedical Research Building surround a fully occupied basement, meaning the ratio between structure and GIA is very efficient.

- The Dementia Research Institute result shows how the form of the building influences the figures. The building is a simple cube, with minimal voids, as compared with the complicated form of the Urban Sciences Building.

Facades

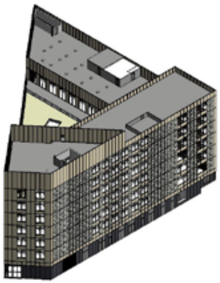
Urban Sciences Building

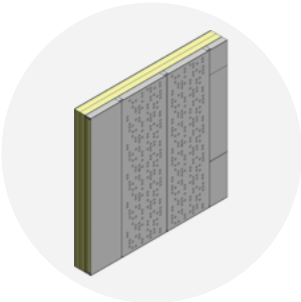
The living laboratory

Location: Newcastle, UK
Client: Newcastle University
Sector: Education
Service: Architecture, interior design, sustainability, research
Scope: New build
Brief: Gallery, decision theatre, office, seminar rooms, lecture rooms, cafe, maker spaces, robotics labs, social space, water and energy monitoring labs, energy storage
Size: 12,800 sq m
Sustainability: BREEAM Excellent, Bespoke Framework, Blueprint Award 2018 for Best Sustainable Project (shortlisted), Lord Mayor's Design Award 2018 for Sustainability
Status: Complete

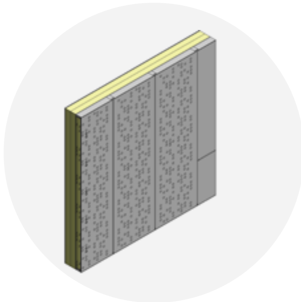
The original Urban Sciences Building facade study, requested by the client as a decision making tool, was another early manual analysis. This led to the birth of H\B:ERT. The study highlighted how much the concealed parts of the building - the secondary support systems, often made of aluminium, have on the overall embodied carbon and the effect can be reduced by specifying recycled products.

The study opposite shows a comparison between the cladding types that are currently installed on the building. Interestingly the unitised cladding has a higher embodied carbon than the rain screen stick system. More analysis would need to be done to understand why, but it is most likely the extent of support structure required. The benefit of specifying recycled metal products can be seen in the third option analysed.

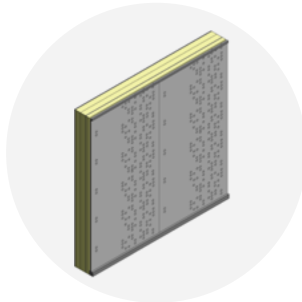




Steel stick system with aluminium panel



Unitised aluminium facade

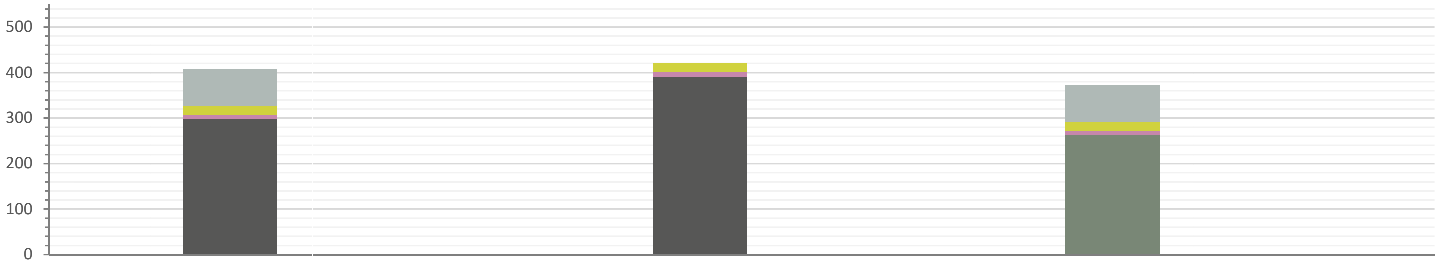


Steel stick system with recycled aluminium panel

407 kg/CO_2e/m^2
average embodied carbon

421 kg/CO_2e/m^2
average embodied carbon

372 kg/CO_2e/m^2
average embodied carbon



Biomedical Research Building

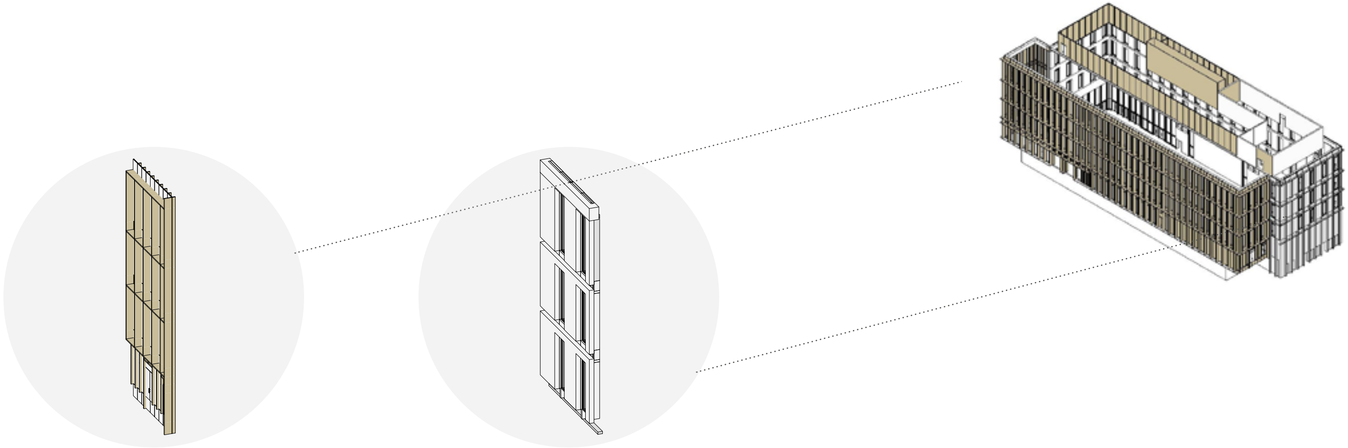
Spaces to promote collaboration

As described earlier, the structural design has been developed to maximise the use of exposed timber in areas where users will spend the most time. A comparative facade analysis has also been carried out at design stage to inform decision making. The facade is a combination of glass, aluminium and pre-cast concrete. In order to protect the internal timber finishes and shade the glass, deep aluminium framing was specified.

This study showed the huge impact that requirement has on the total embodied carbon.

This study also made clear the need to understand the detail within the 3D model at each design stage. The window mullions were modelled as solid elements initially, but as the model was refined the embodied carbon reduced.

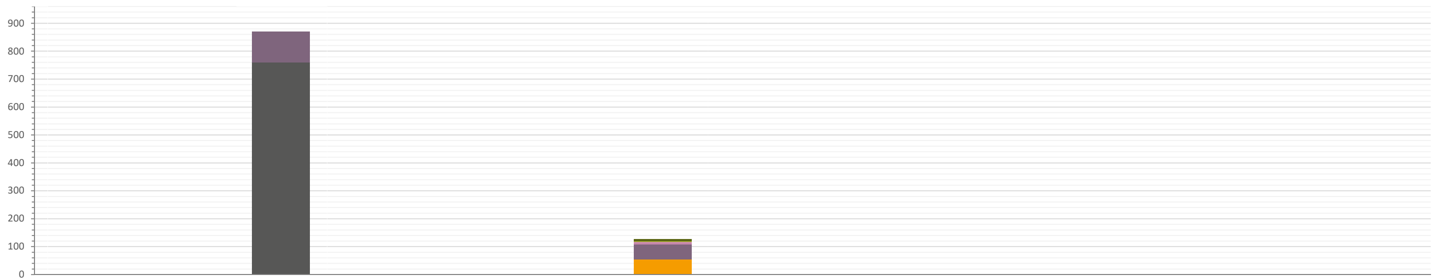
Location: Warwickshire, UK
Sector: Education
Service: Architecture, interior design
Scope: New build
Brief: Wet laboratories, tissue culture, clean rooms, magnet labs, write-up spaces, cellular offices, seminar and meeting rooms, lecture theatre, café, social spaces, collaboration spaces
Size: 6,800 sq m
Sustainability: BREEAM Excellent
Status: Construction



Aluminium / Glass **Concrete**

870 $kg/CO_2e/m^2$
average embodied carbon

126 $kg/CO_2e/m^2$
average embodied carbon

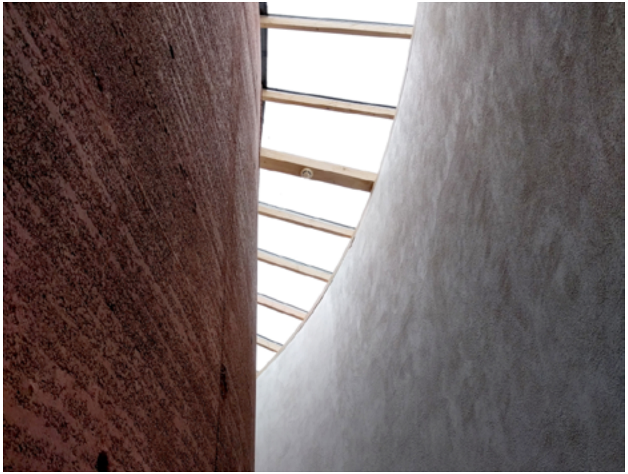


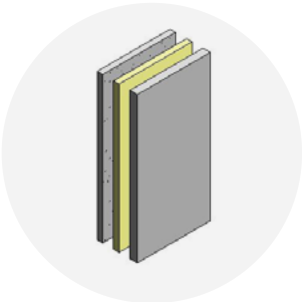
Estuary Museum
Celebrating local materials

The material treatment of this building is designed to celebrate its local environment and reflect the areas history. Rough, hard wearing finishes are being explored to cope with the sea air and reflect local geology. As we are at the early design stages we have used the H\B:ERT tool to test some facade options including rammed concrete, pre-cast concrete and rammed earth, using on site excavation material.

There are two interesting findings that are immediately obvious.
- Adding an additional cavity to improve the thermal performance adds more aluminium framing and increases the embodied carbon.
- Although the rammed earth system modelled includes some cement and steel supports it still uses the least embodied carbon.

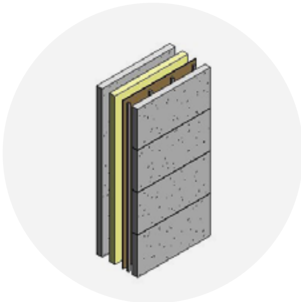
Location: UK
Sector: Civic, community & culture
Service: Architecture
Scope: New build
Brief: Gallery spaces, cafe, public landscape
Sustainability: BREEAM Excellent
Status: Concept





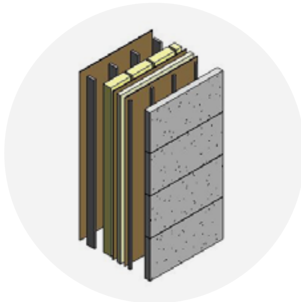
Reinforced & rammed concrete

156 kg/CO_2e/m² average embodied carbon



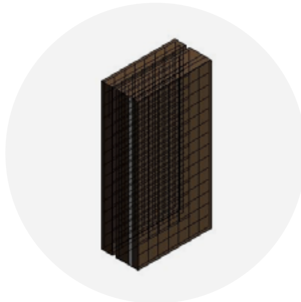
Reinforced & precast concrete panel

231 kg/CO_2e/m² average embodied carbon



SFS & precast concrete panel

514 kg/CO_2e/m² average embodied carbon

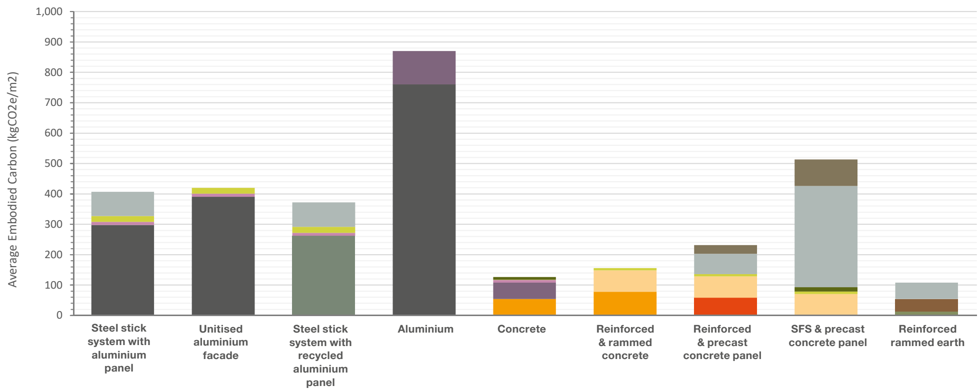


Reinforced rammed earth

108 kg/CO_2e/m² average embodied carbon

Facades
Lessons learnt

There is clear benefit in carrying out these embodied carbon studies at an early design stage. In addition, the process of analysing panels rather than whole façades has meant the data can be compared easily and used as a gradually developing design library.



Urban Sciences Building

- The concealed aluminium framing has the most impact on the embodied carbon figure.

- Rainscreen cladding performs slightly better than a unitised cladding, mainly due to the support framing required.

- The heavier the cladding panel, the greater the embodied carbon as it requires more support structure, generally made from metal.

- The benefit of specifying recycled metal products can be clearly seen.

Biomedical Research Building

- The deep aluminium framing has the most impact on the embodied carbon figure.

- Pre-cast concrete panelling, by contrast, has a lower figure. We presume this is because it is generally self-supporting and is restrained only.

- Modelling techniques play a great part. At early design stages where framing elements are roughly modelled it may be sensible to apply an allowance for refinement to ensure options are compared like for like.

Estuary Museum

- Adding an additional cavity to improve the thermal performance adds more aluminium framing and increases the embodied carbon.

- Although the rammed earth system modelled includes some cement and steel supports it still uses the least embodied carbon.

- Rammed concrete performs better than pre-cast concrete, as the concrete only requires metal straps back to main structure. The pre-cast boards rely on a substantial secondary support structure.

Interiors

UCL at Here East

A centre for cross-disciplinary research

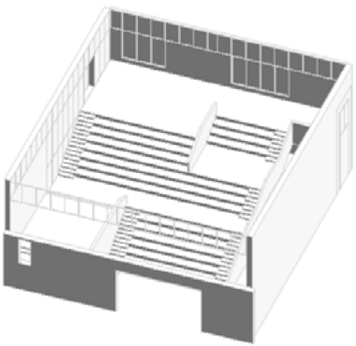
Location: Hackney, London, UK
Client: University College London
Sector: Education
Service: Architecture, interior design
Scope: Retrofit
Size: 6,200 sq m
Sustainability: SKA Gold
Status: Complete

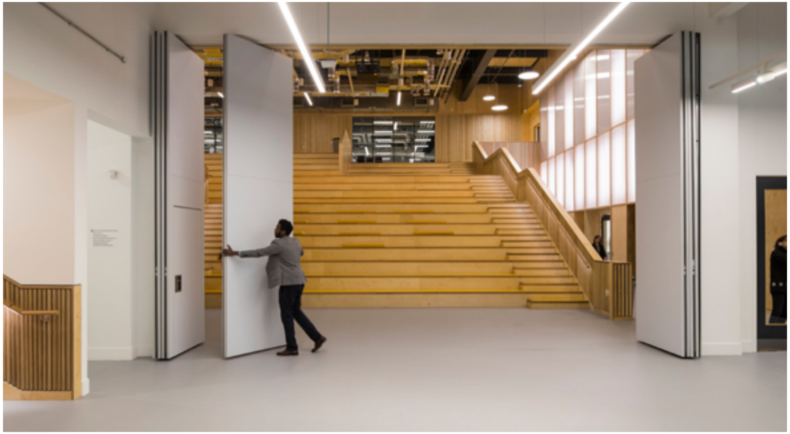
Within the auditorium of UCL at Here East the decision was taken to clad the space, including the stair, with plywood rather than drylining. This was both an aesthetic and acoustic decision.

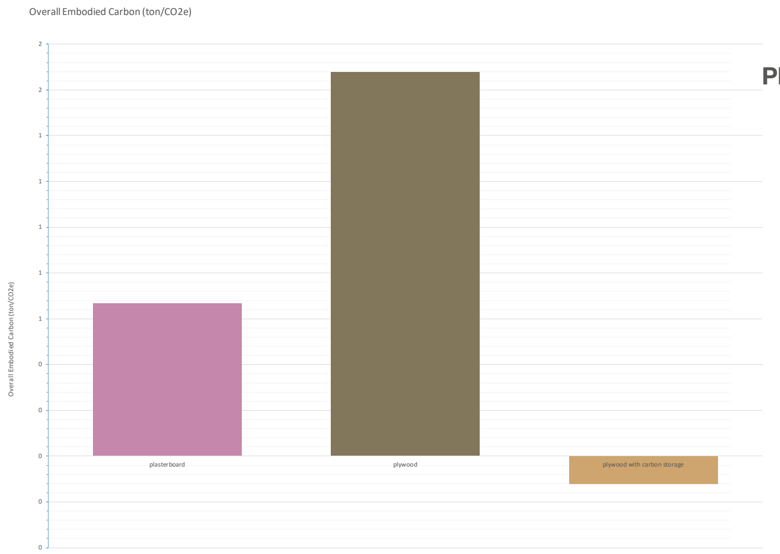
We have tested the two finishes, assuming the same secondary support structure and severe duty rated performance. Our expectation was that the plywood would have less embodied carbon.

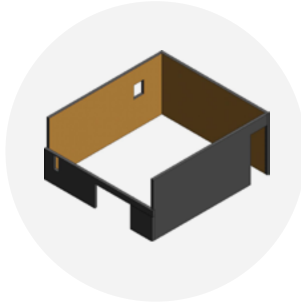
Initial results show the embodied carbon of the plywood option is more than twice as high as the equivalent dry-lining. However, if the carbon storage capacity of the plywood was taken into account the figures change significantly. The results opposite show that plywood is then negative.

This study shows the importance of interrogating the carbon emissions factors.









Plasterboard with timber studs

0.67 ton/CO_2e
total embodied carbon

-0.05 ton/CO_2e
total carbon stored in timber

= 0.62 ton/CO_2e
total embodied carbon with carbon storage

Plywood with timber studs

1.68 ton/CO_2e
total embodied carbon

-1.80 ton/CO_2e
total carbon stored in timber

= -0.12 ton/CO_2e
total embodied carbon with carbon storage

Cast Offices

Brand, modularity and prefabrication

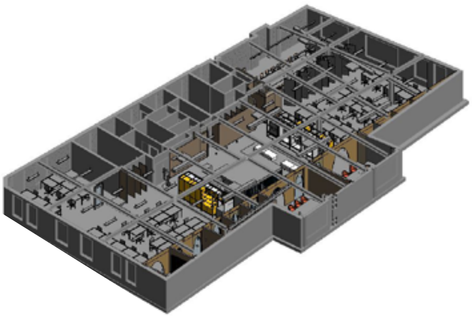
Location: Farringdon, London, UK
Client: Cast Consultancy
Sector: Workplace
Service: Interior design
Scope: Fit-out, refurbishment
Brief: Open-plan work area, meeting rooms, break out areas, collaboration spaces
Size: 500 sq m
Status: Complete

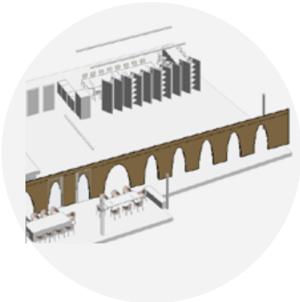
The Cast offices lacked a hierarchy and separation between noisy and quiet activities. The design introduced a new arched screen across the space and various material options were analysed.

It is clear the glass and steel construction would have introduced a huge embodied carbon load into the project.

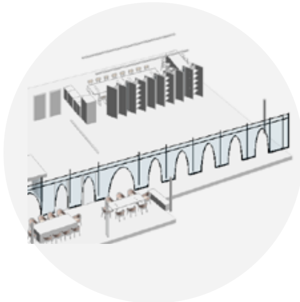
The Cross Laminated Timber option was chosen eventually, for a range of reasons including its acoustic and visual properties, but also its lower embodied carbon.

An additional element of the scheme is the obvious benefit in exposing the existing brick wall, saving on drylining and paint. Modelling techniques need to be developed to capture this level of detail within the tool.

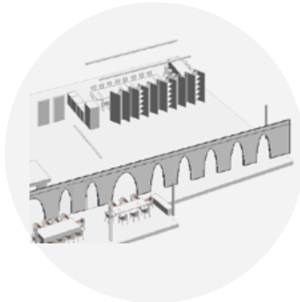




CLT



Glass / Steel

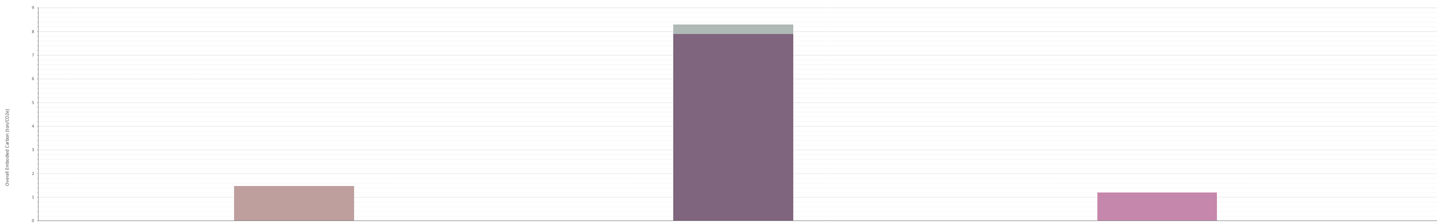


Plasterboard

1.47 ton/CO_2e
total embodied carbon

8.50 ton/CO_2e
total embodied carbon

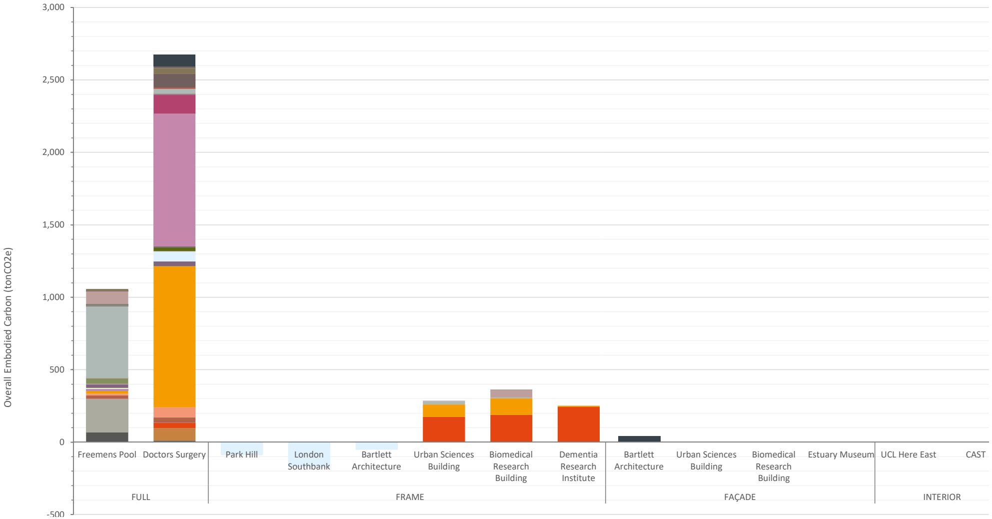
1.20 ton/CO_2e
total embodied carbon



Full analysis
Next steps?

A key aim of this research so far has been to carry out whole building and elemental assessments to build up a database of lessons learnt and comparative options.

Our next steps are:
- to contribute to the establishment of benchmarks for specific building types
- further develop 3D modelling techniques that make the analyses more streamlined
- interrogate how 3D modelling can assist in measuring challenging areas, like finishes and MEP



H\B:ERT has proven very useful in materials analysis at all stages of the design process, and especially when decisions are being made. Through our continued use and making it freely available, we hope to share data across the industry so that embodied carbon can become part of a design decision making framework through greater accessibility of data.

To find out more about our practice or talk to us about your project, contact:

Louisa Bowles
Partner
LouisaBowles@hawkinsbrown.com

Jake Attwood-Harris
Sustainable Design Consultant
JakeAttwoodHarris@hawkinsbrown.com

London
159 St John Street
EC1V 4QJ
+44 (0)20 7336 8030

Manchester
3C Tariff Street
M1 2FF
+44 (0)161 641 5522

Edinburgh
Spaces, 1 Lochrin Sq
92 Fountainbridge
EH3 9QA
+44 (0)131 370 8820

Los Angeles
724 S. Spring Street
Suite 1403
CA 90014
+1 213 493 2001

hawkinsbrown.com

mail@hawkinsbrown.com

AJ100 Practice of the Year 2016 & 2017