Carbon tracking and calculation

16 January 2024

@buildoffsite @CIRIAupdates

Project calculation

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Buildoffsite
22 January 2024

SHEPPARD ROBSON

360 people
200 awards
80+ years
3 locations
36 languages

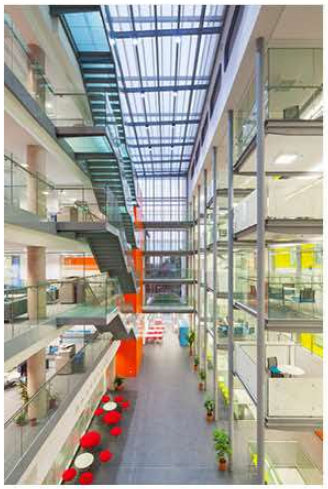
Overview

Community
Health + Care
Homes
Hotels + Leisure
Interior Design
Masterplanning
Retail
Schools + Colleges
Science + Tech
Student Living
Universities
Workplaces

Sectors








SHEPPARD
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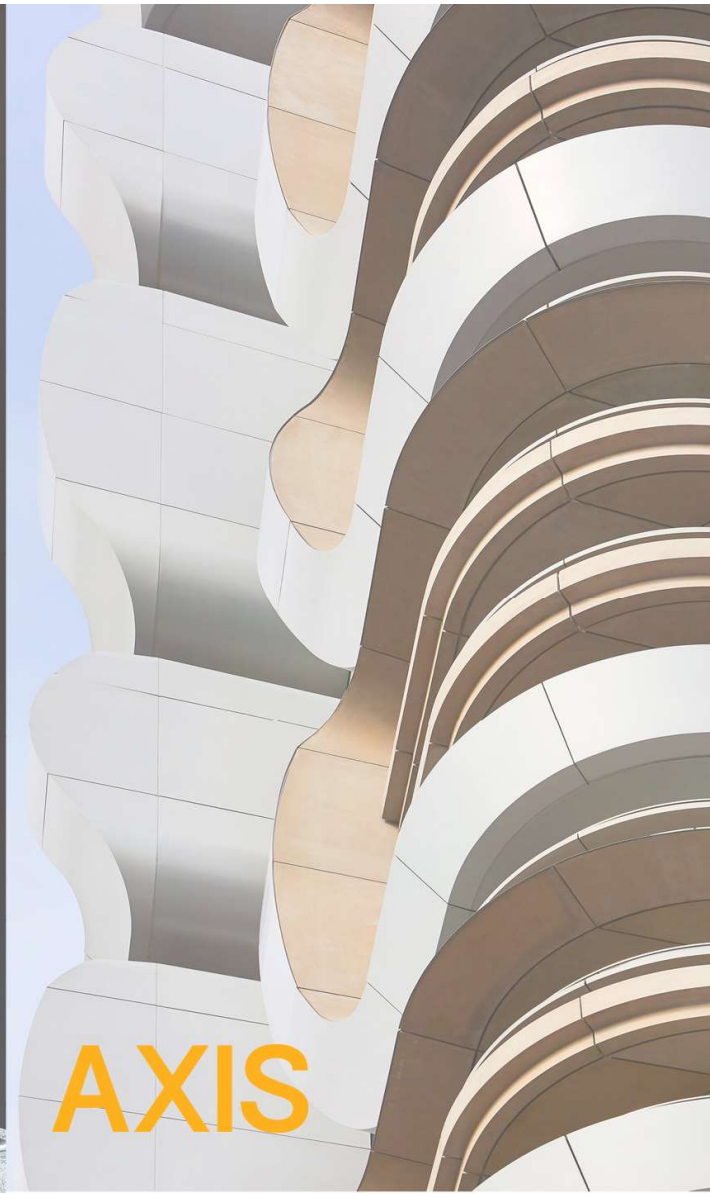
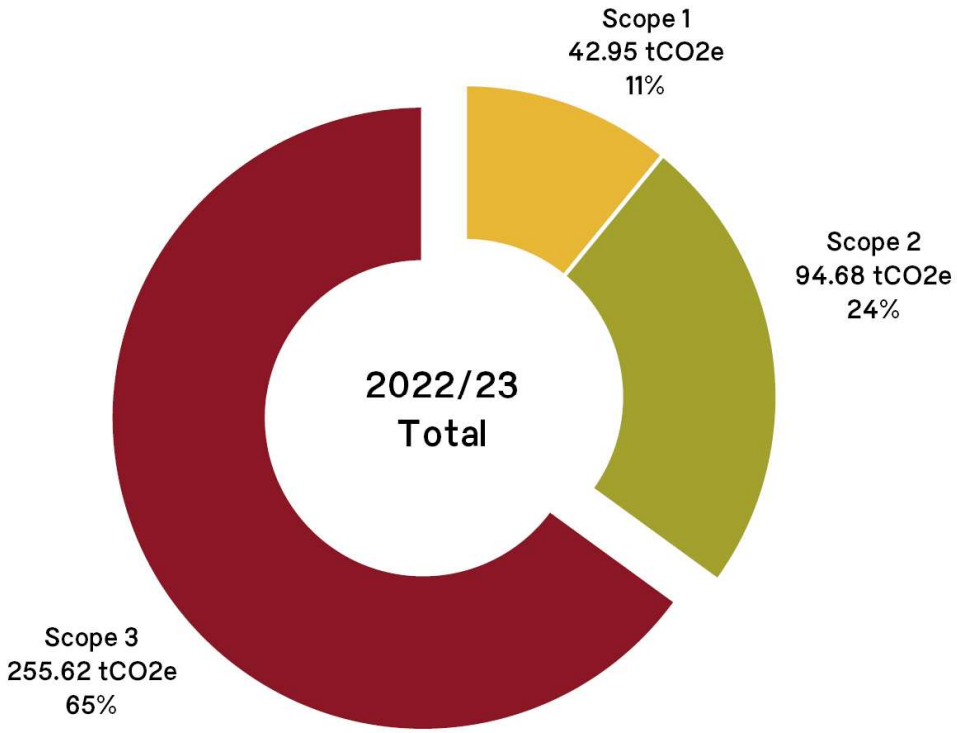
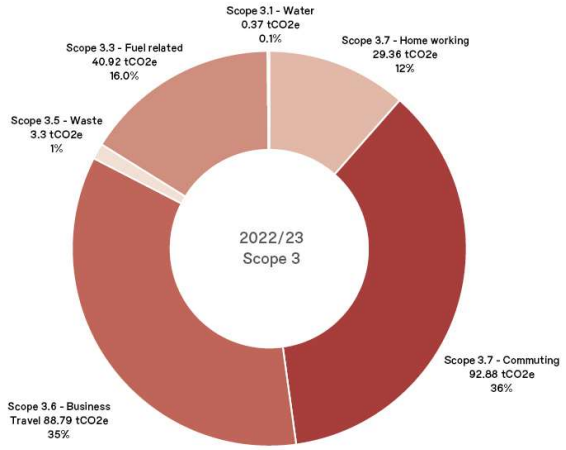
ID:SR

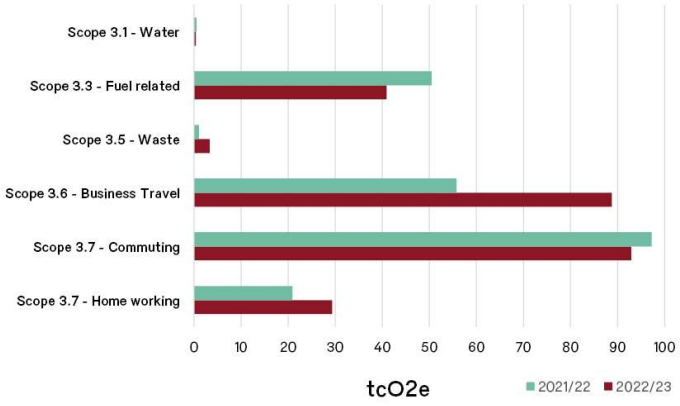

AXIS

- ISO 9001 + 14001 certified
- Certified Passivhaus Designers
- UKGBC Advisory Group Board
- Signatories of UK's Architects Declare Climate + Biodiversity Emergency Commitment
- Former Sustainability Advisor to RIBA
- Signatories of RIBA 2030 Climate Challenge
- Signatories of AJ Retrofirst Campaign

Sustainable innovation since 1938







Overall carbon footprint

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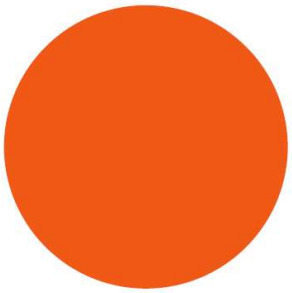
Carbon footprint

UK AVERAGE CARBON
FOOTPRINT PER PERSON

12.7 TCO2E

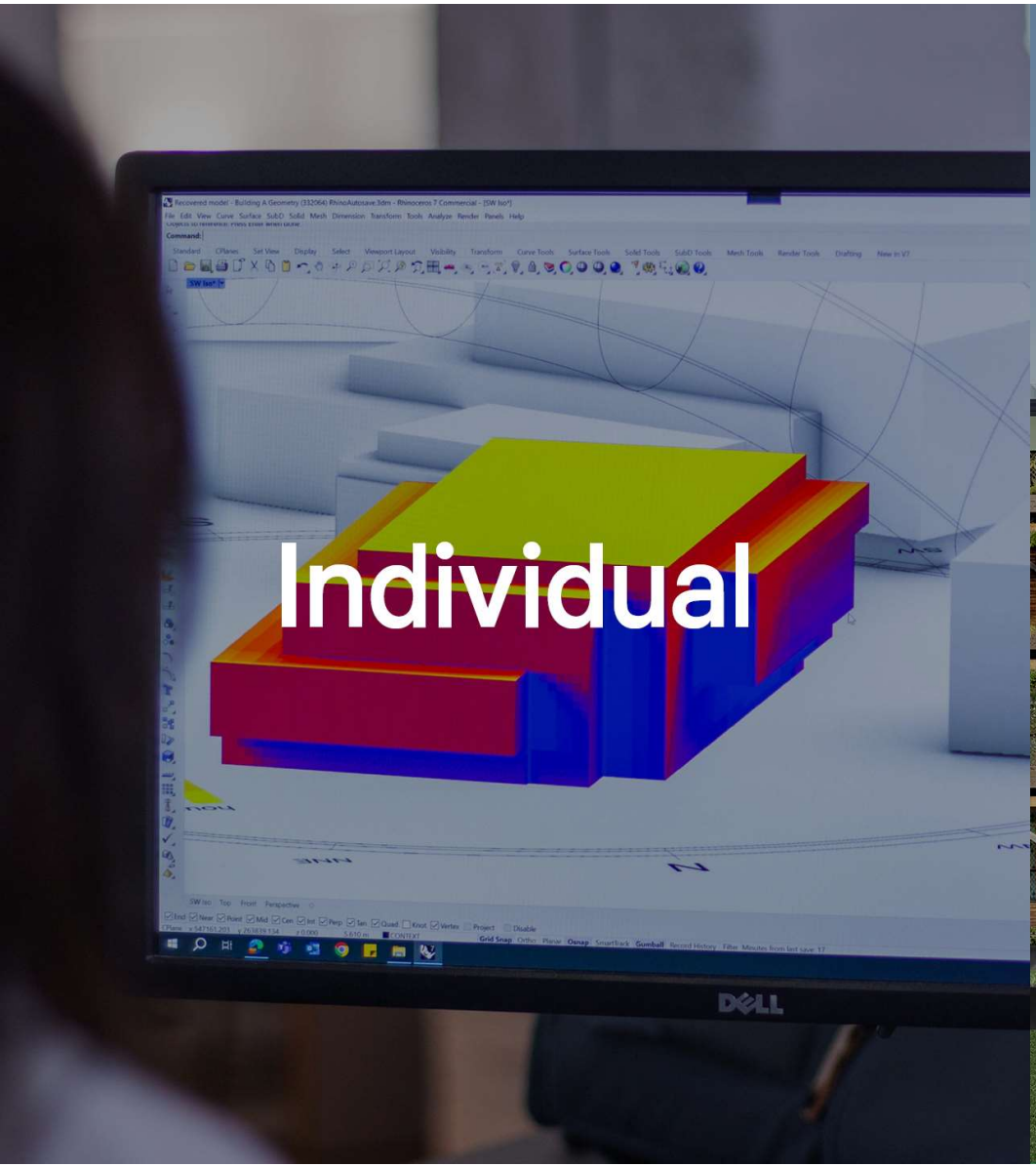


SR CARBON FOOTPRINT

393.25 TCO2E

EXAMPLE PROJECT CARBON
FOOTPRINT (A1-A5 ONLY)

APPROX 17,000 TCO2E


Individual


Collective

Holistic design

Passive design

Active design

Parametric design

Embodied carbon

Health + wellbeing

Measurement POE

Nelson Mandela Children's Hospital

245 Hammersmith Road

Collaborative Teaching Laboratories

Siemens Middle East HQ

20 Finsbury Circus

Deloitte HQ

Lancaster Institute for the Contemporary Arts

Sustainable design approach

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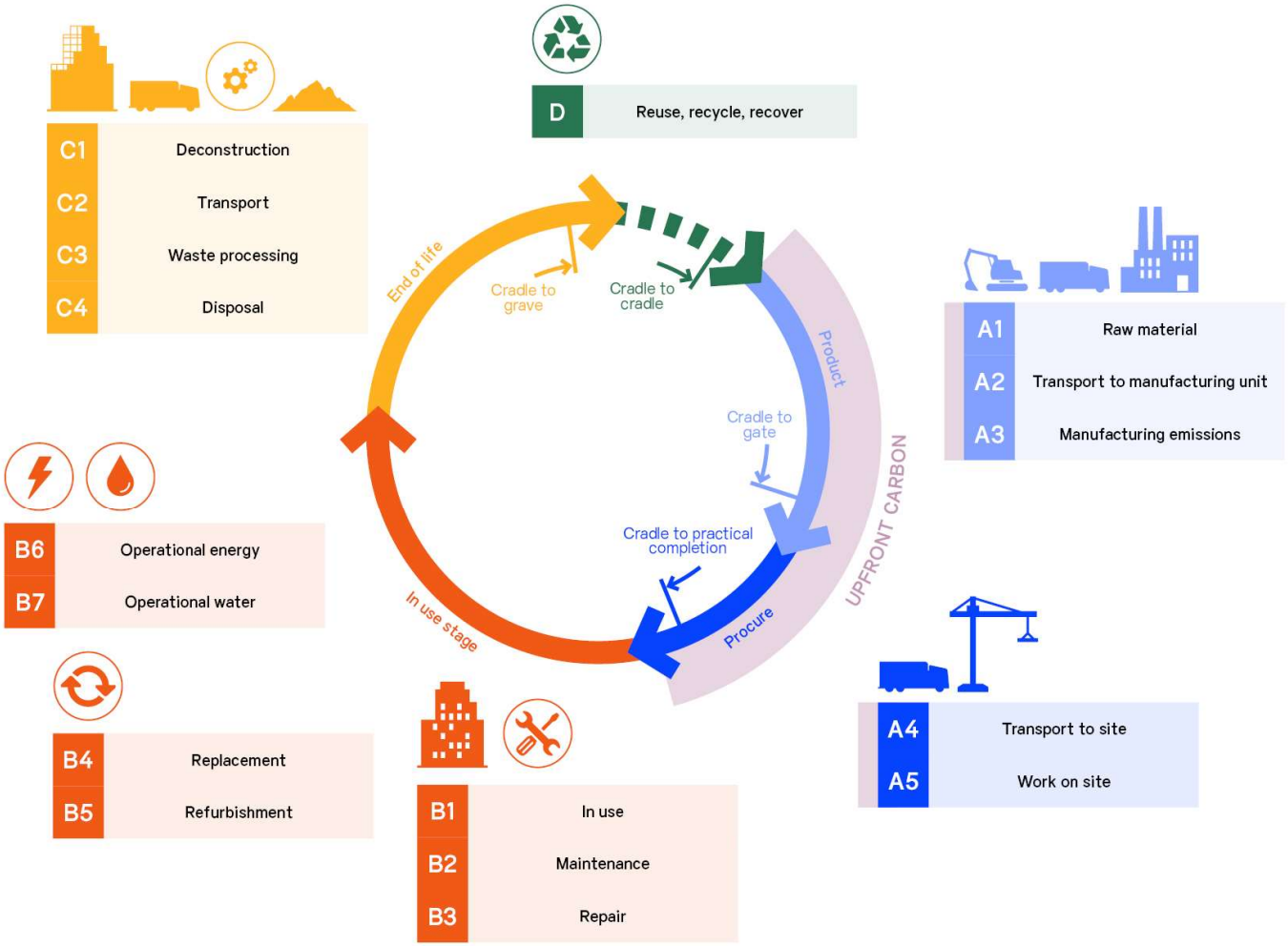

Whole Life Carbon Modules BS EN 15978

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Note:
Steps aligned with UKGBC Net Zero Carbon Buildings Framework.

Net zero carbon roadmap

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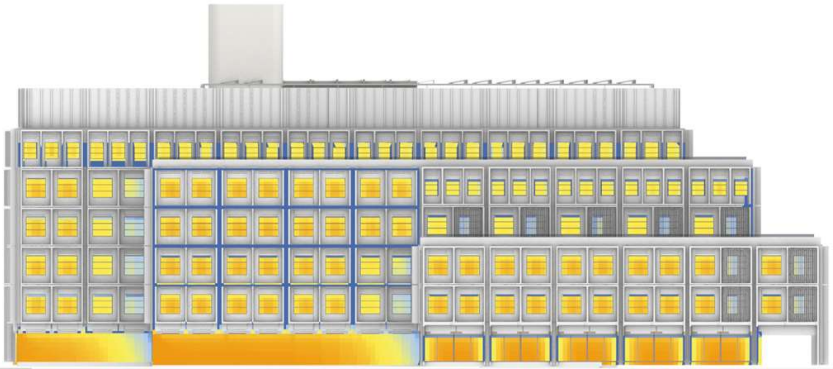
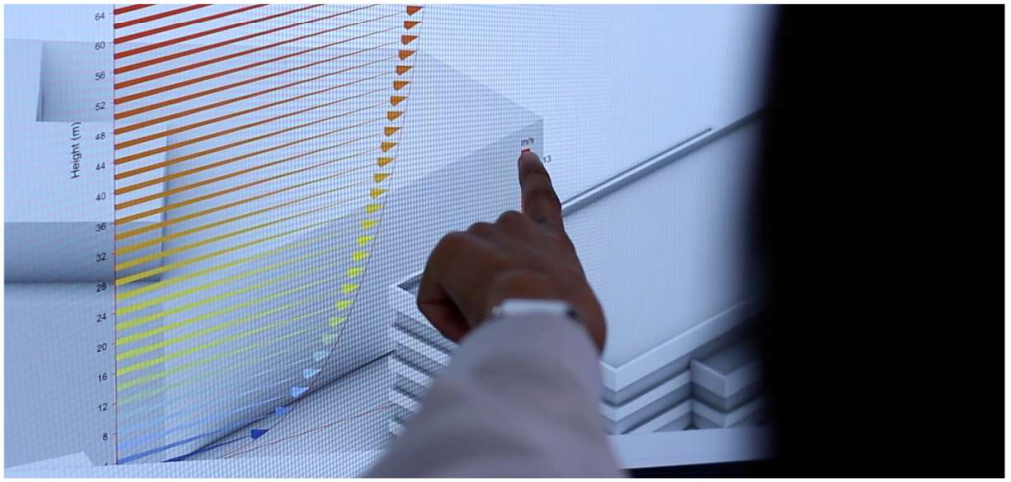


Project Seed
Image credit:
Laura Lapadat



- PHPP
- Ladybug and Honeybee
- Forma

In-house Passive Design Tools

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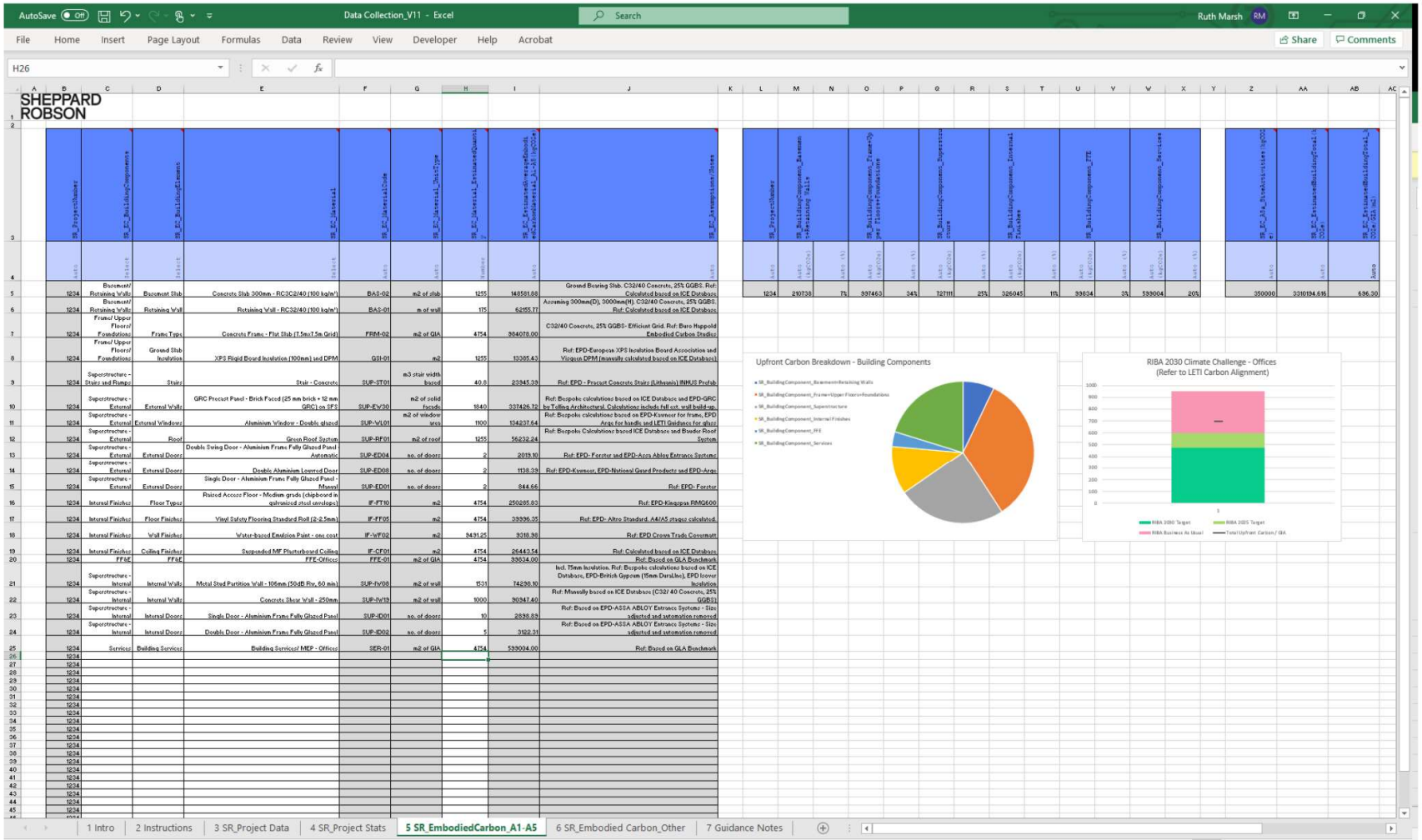
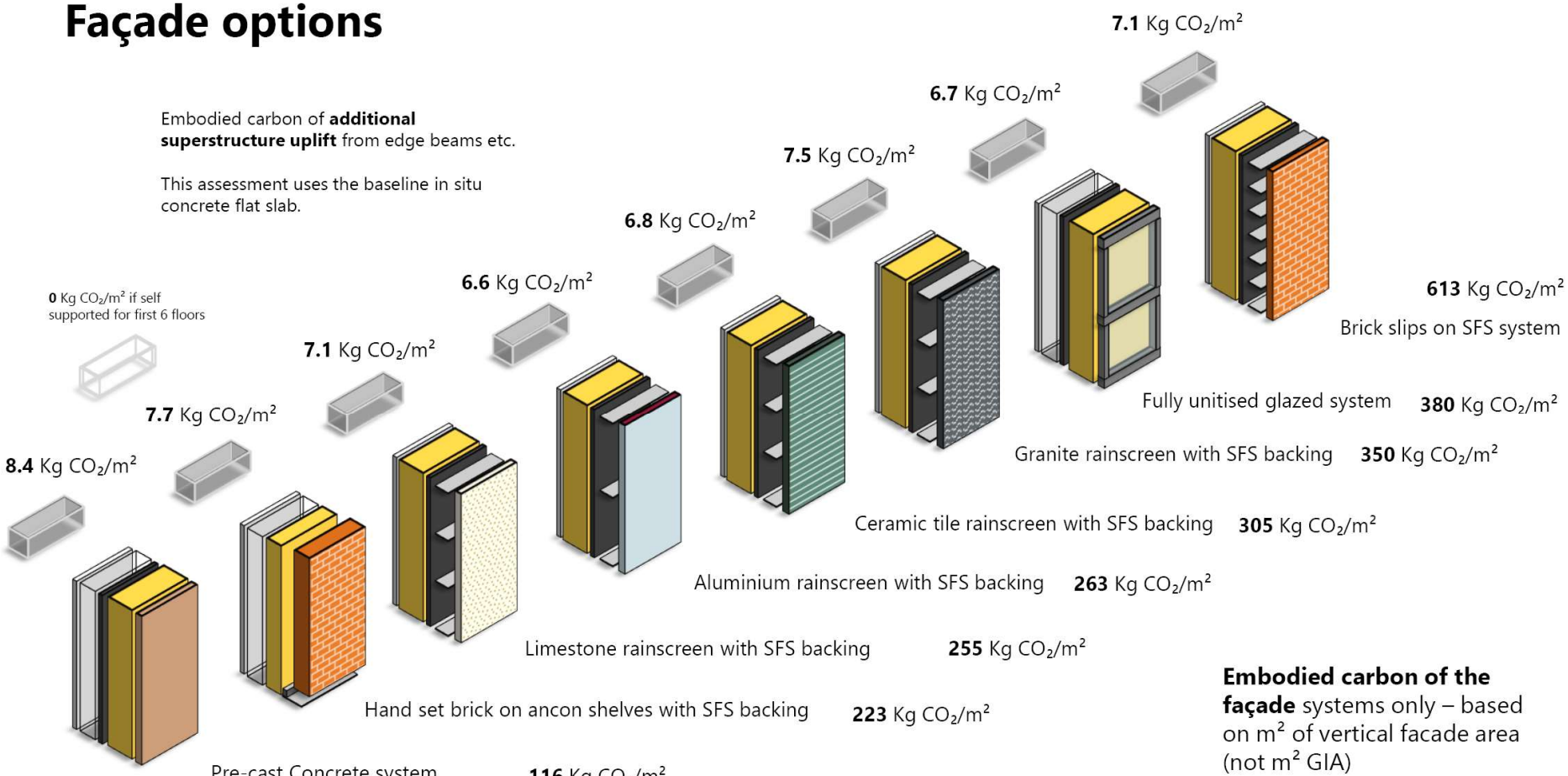


Up Front Carbon Tool

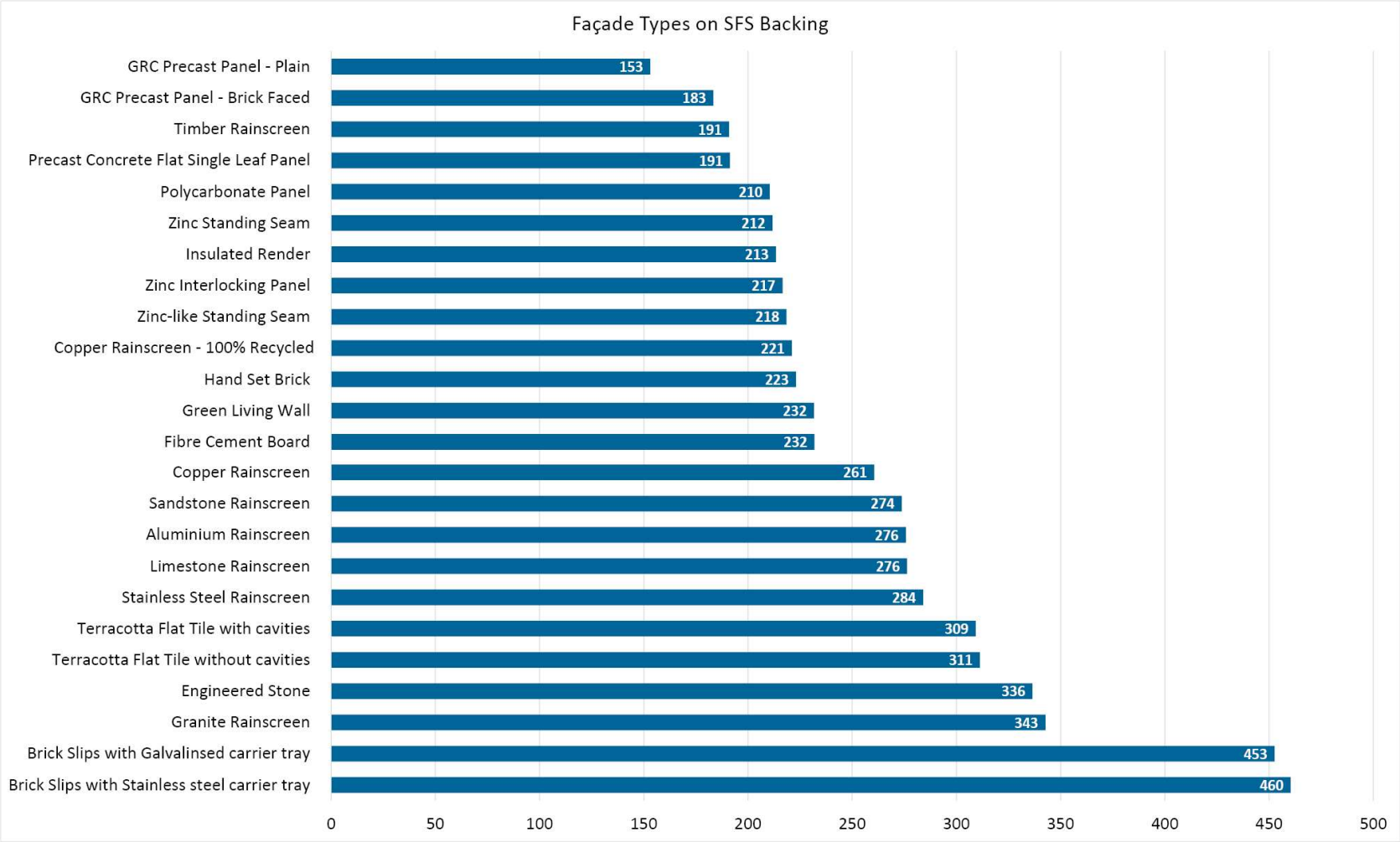
Courtesy of Buro Happold

Façade options



Embodied carbon of the façade systems only – based on m^2 of vertical facade area (not m^2 GIA)

Façade Analysis



Façade Analysis from In-House Tool

Low Carbon Materials Library

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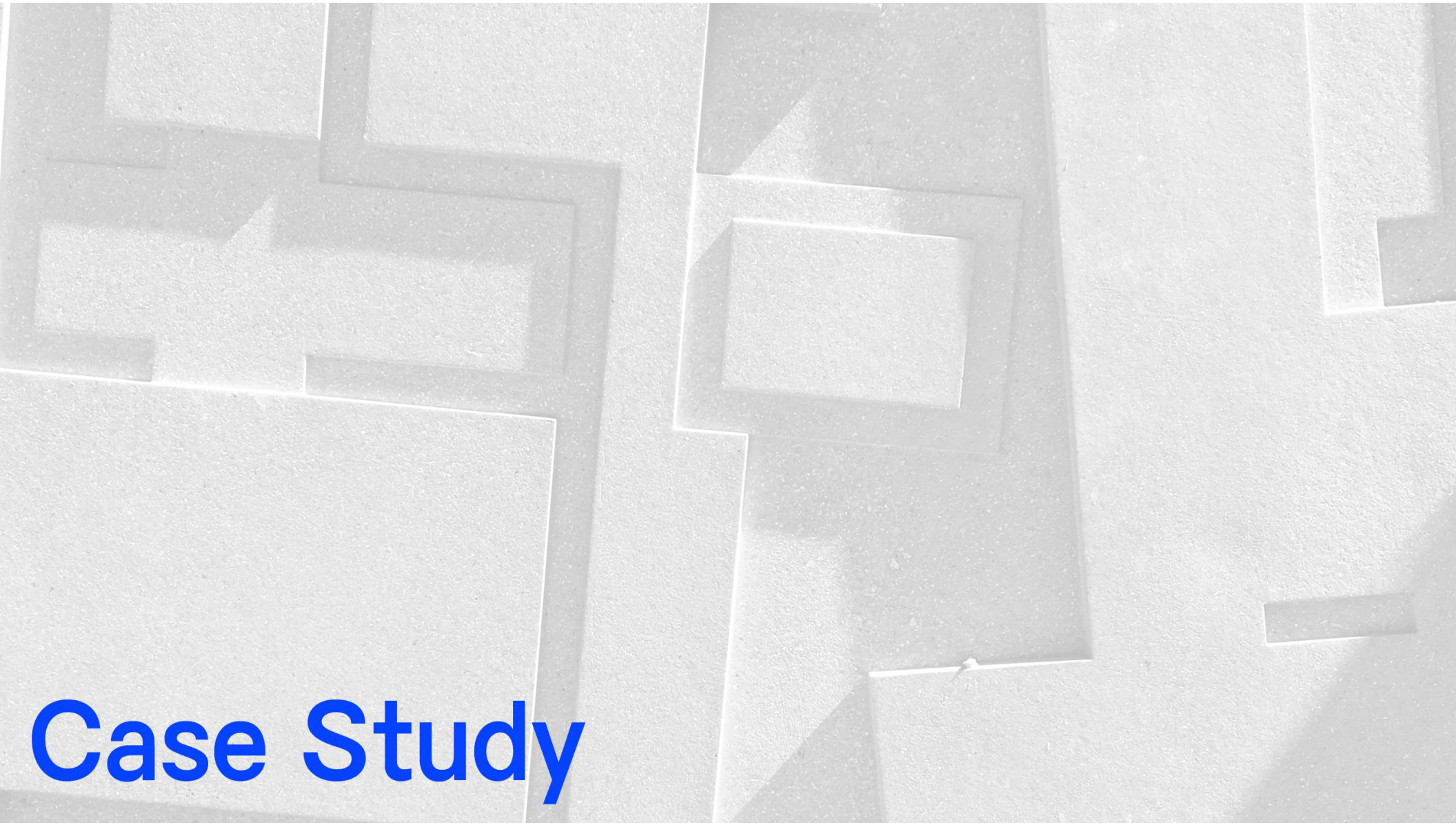


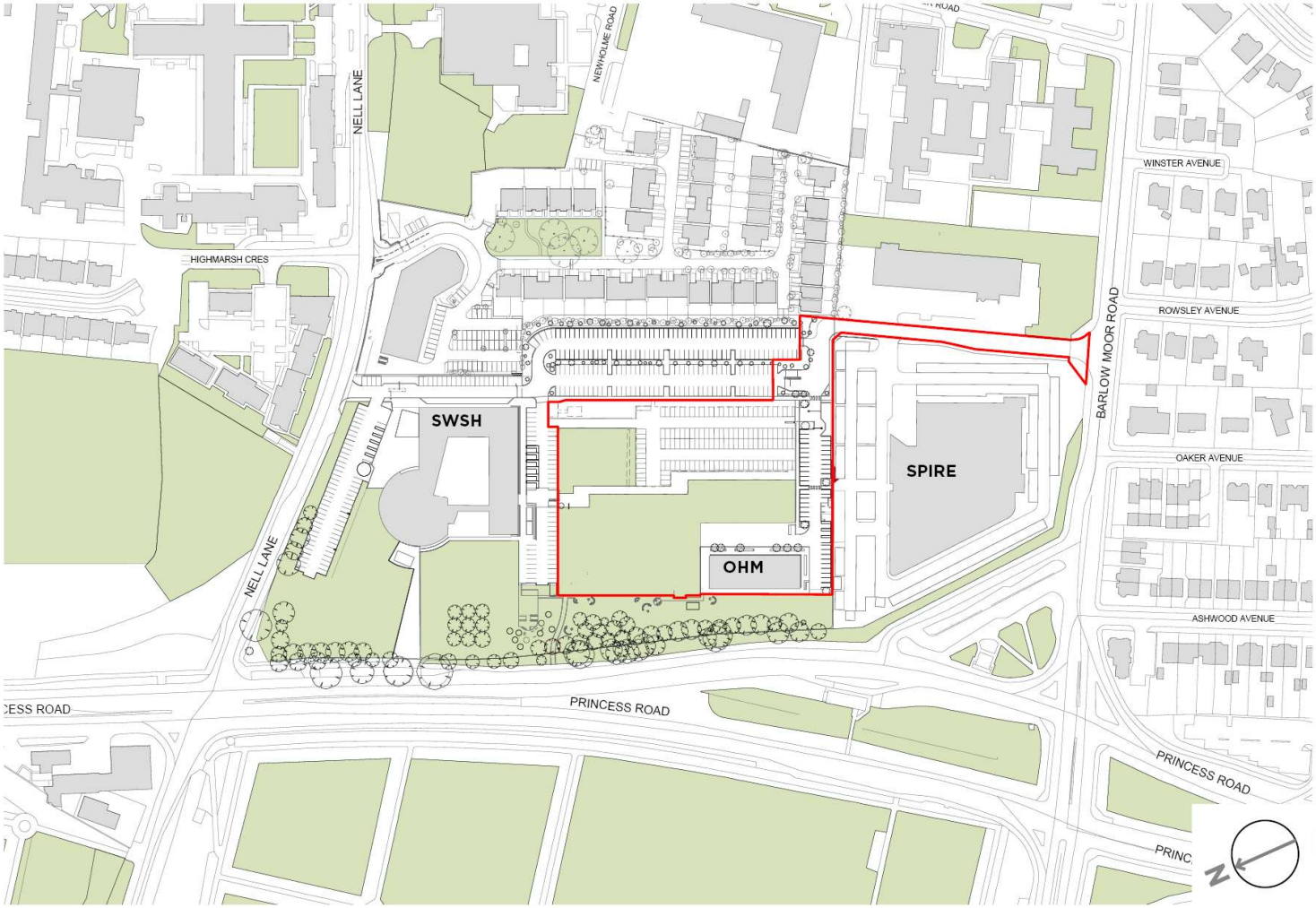
Case Study

- Location: Manchester
- Client: Bruntwood

EvO Building

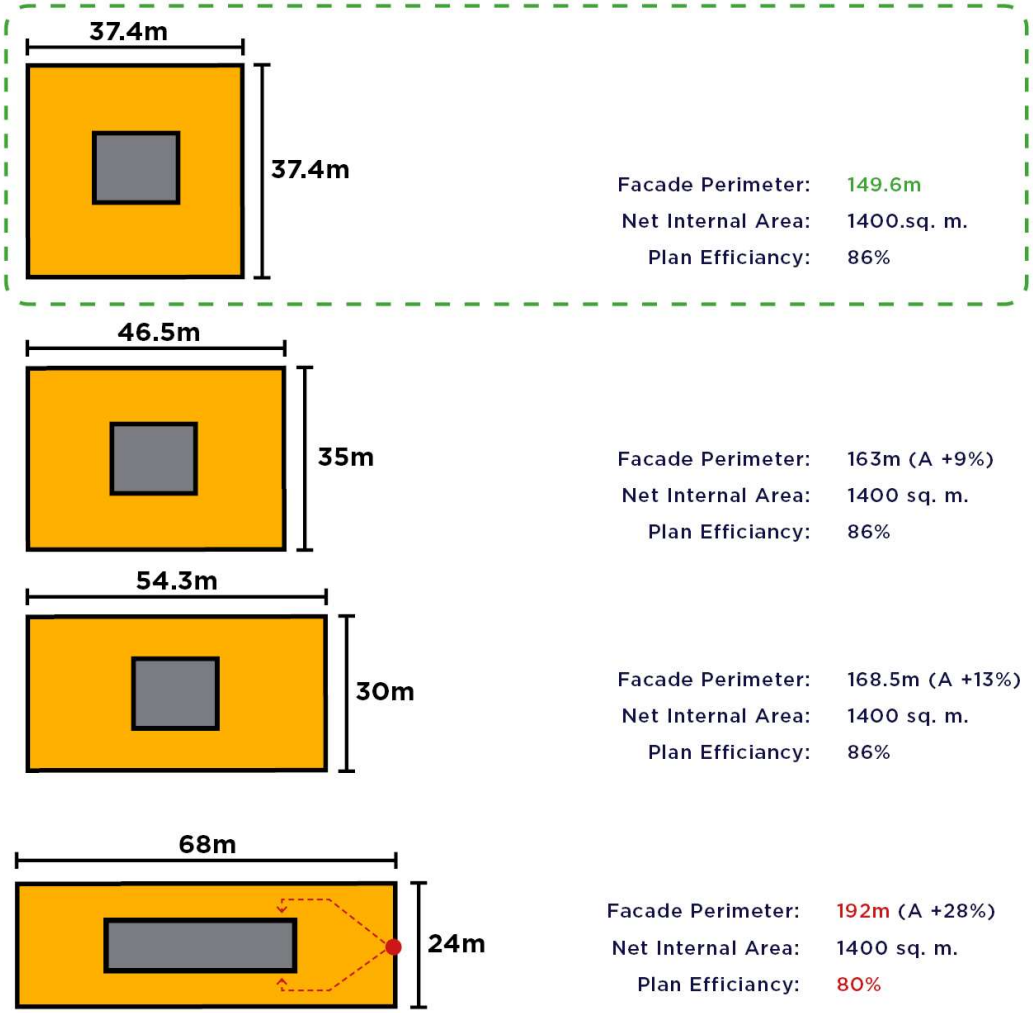
- Edge of town
- Flat Site
- Near busy road

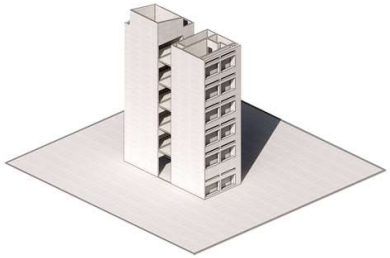
Site Location



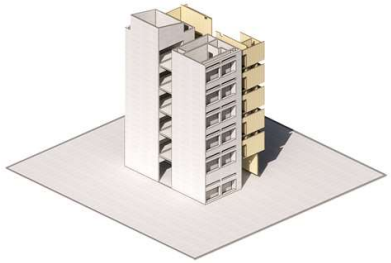
Form Factor

- From factor 0.76, LETI recommend less than 2
- Low form = less heat loss and gain
- Low form factor = less material required to build the facade
- Simple square plan = high efficiency and less material to build building

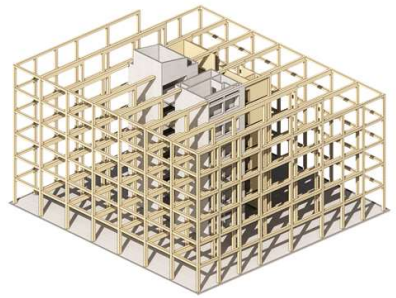




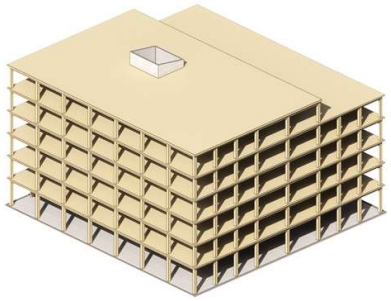
Minimal use of concrete where required for fire compartmentalisation / fire escape.



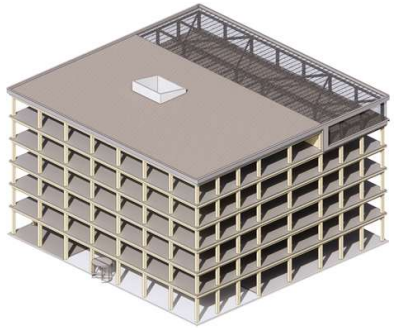
Cross Laminated Timber (CLT) used for non-structural elements



Glulam columns & beams with minimal spans to reduce embodied carbon.



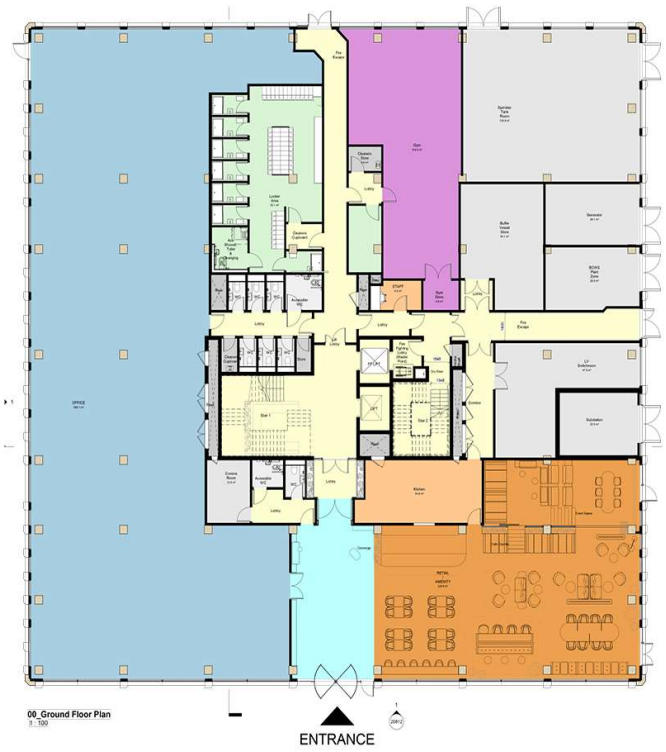
CLT floor slabs at optimal spansto reduce embodied carbon



Raised Access Flooring /Roof / Plant Screen

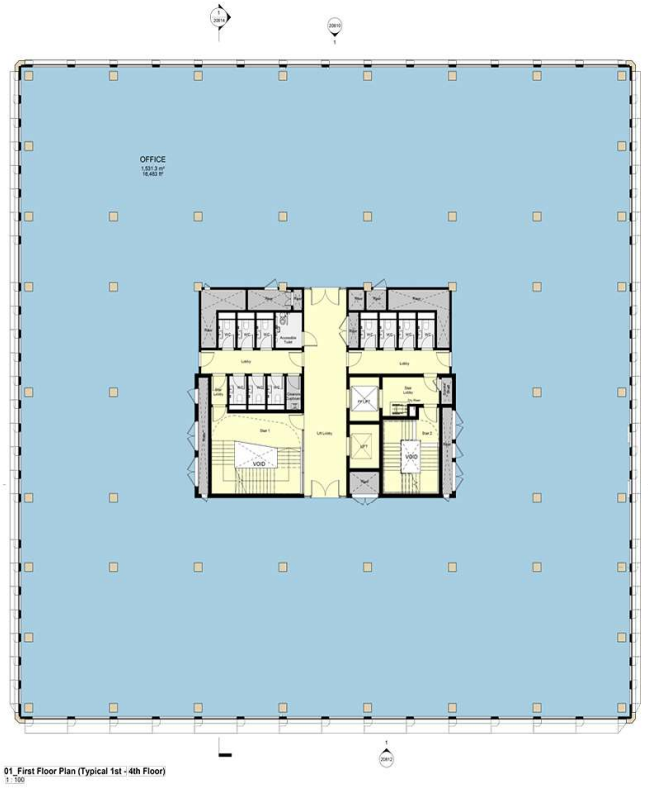
Air tight envelope combining solid and glazed elements

Building Structure



Key

1. Core Circulation
2. Office
3. Riser / BOH
4. WC
5. Plant
6. Reception
7. Retail / Amenity Space
8. Kitchen
9. Staff Office
10. Shower / Changing Facilities
11. Gym / Gym Store



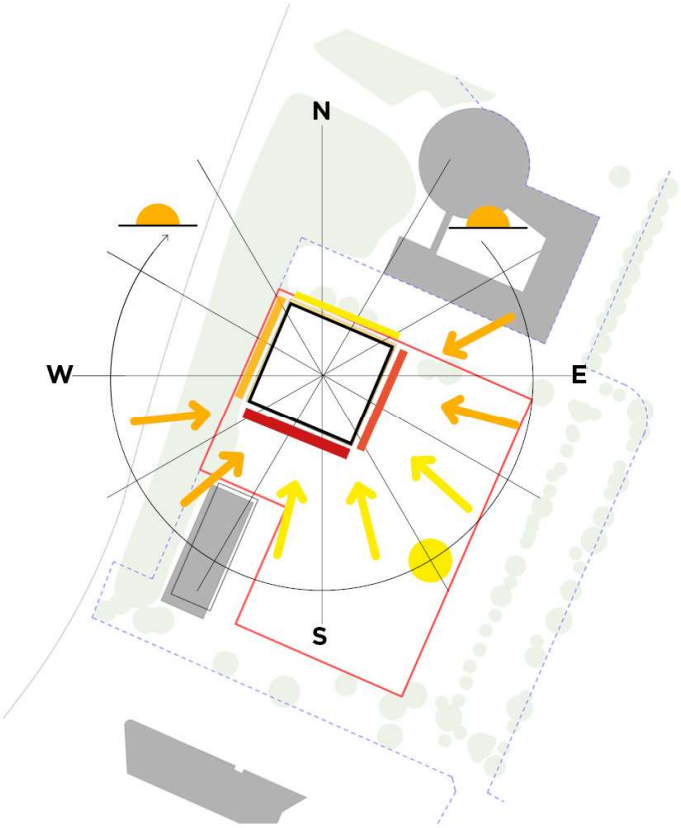
Ground floor Plan

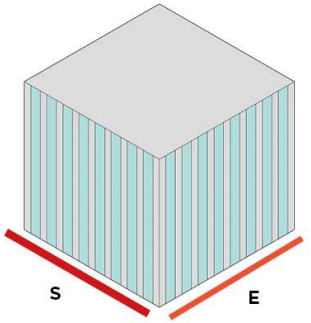
Typical Floor Plan

Building Layout

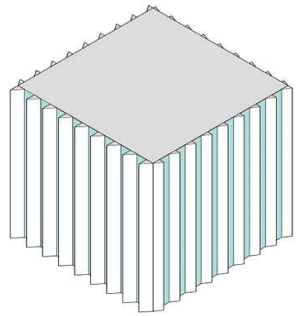
Façade Analysis

- Conclusions from studies
- Low U-value facade not required due to internal heat sources (people, lighting, computers)
- Square floor plate limited peak heating requirements
- Minimising solar gain was important in reducing peak cooling load and annual energy requirements.
- Orientation alone had little impact but when combined with maximising shading to suit sun path the impact was significant

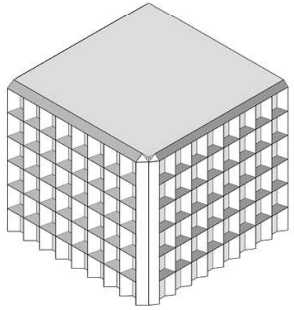




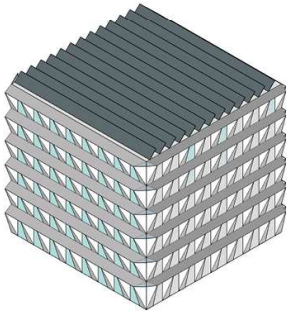
OPTIMISE PERFORMANCE - MAXIMISE DAYLIGHT & MINIMISE HEAT LOSS / SOLAR GAIN



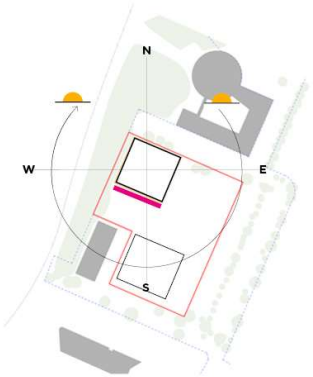
MINIMISE SOLAR GAIN - VERTICAL SHADING

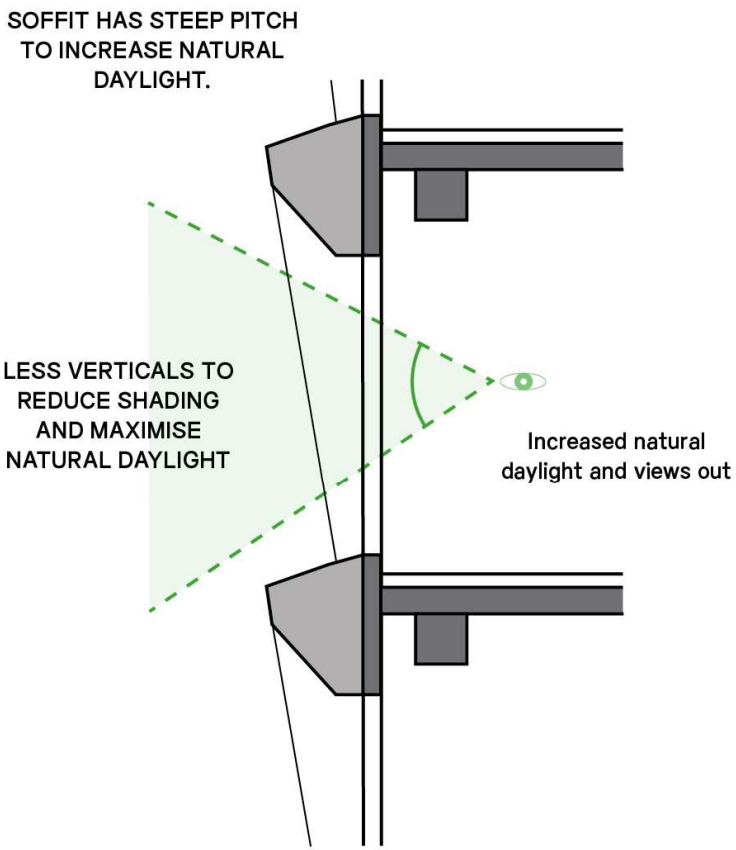


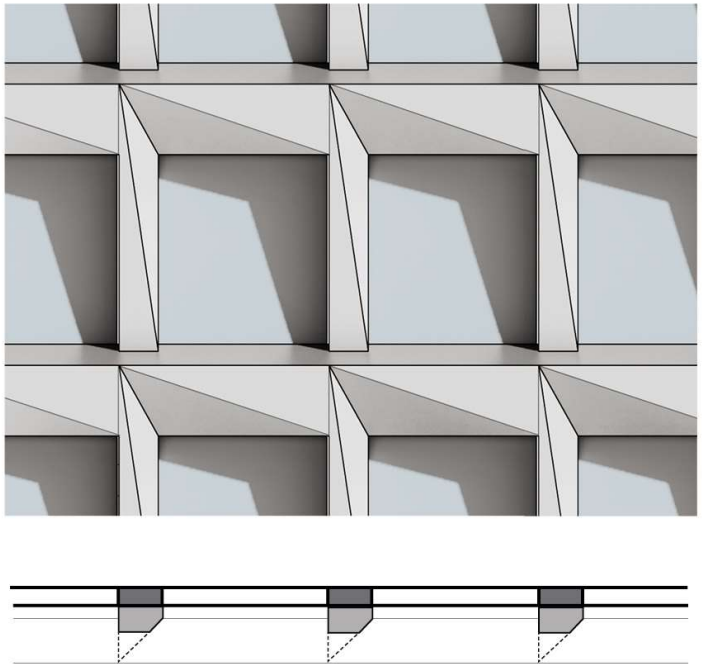
MINIMISE SOLAR GAIN - HORIZONTAL SHADING



OPTIMISE VIEWS / PERFORMANCE WITH SOLAR GENERATION (PV / PVT)

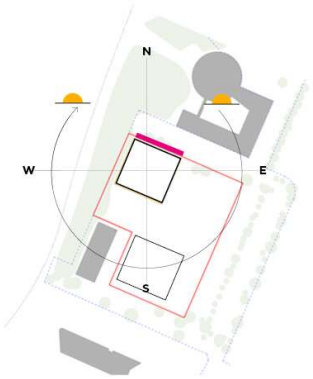


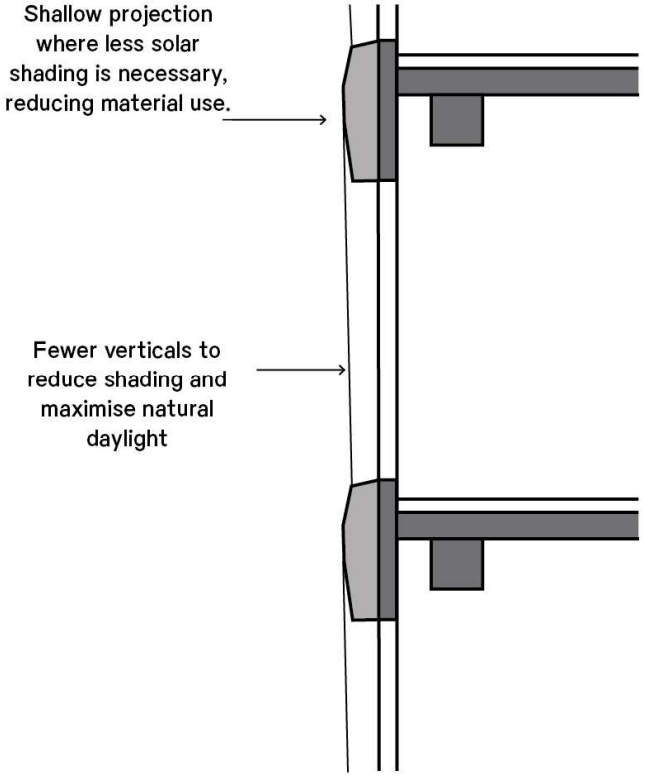


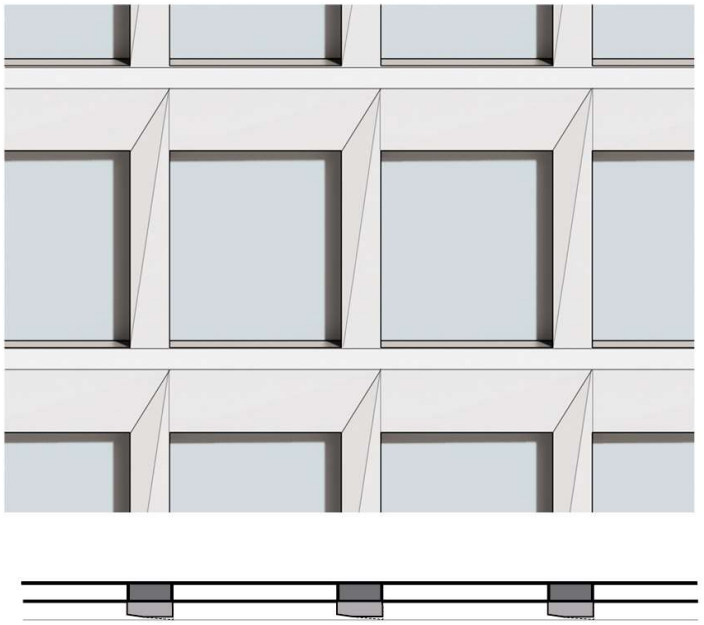


- Minimise solar gain from high south sun via horizontal shading
- Minimise solar gain from hot afternoon west sun from vertical shading
- Angle soffit to maximise daylight

South Façade

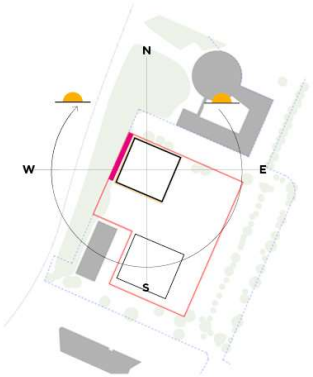


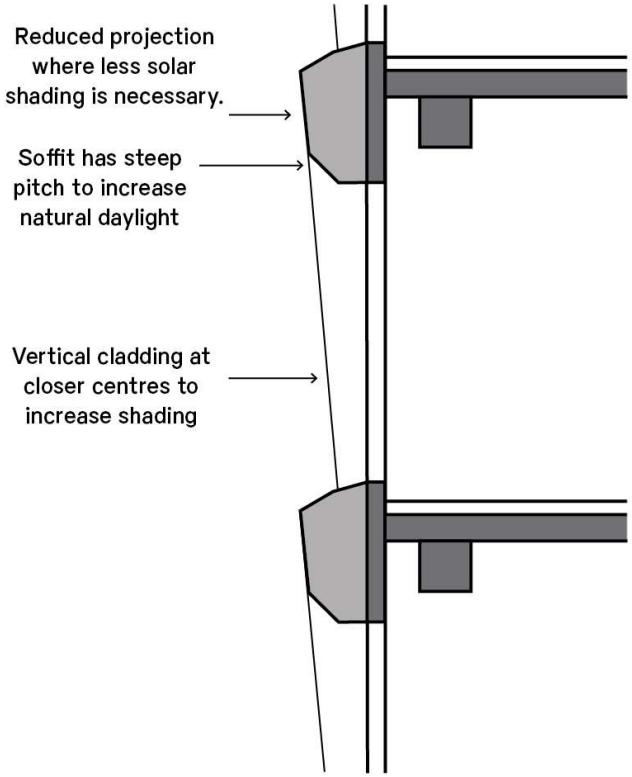


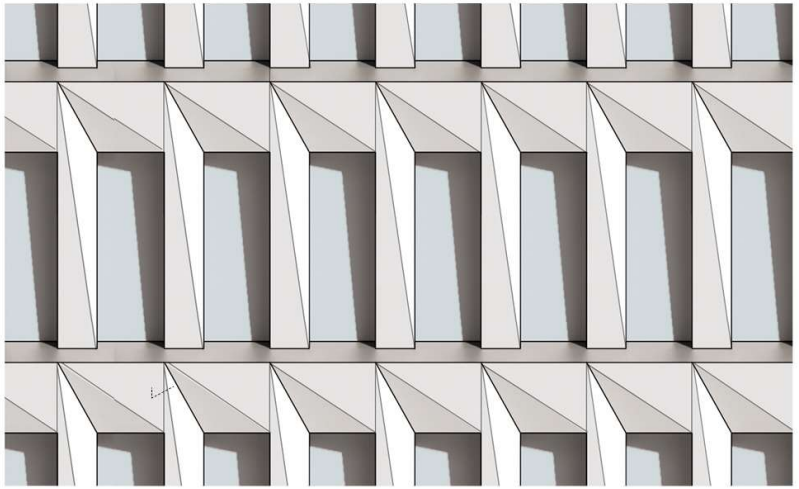


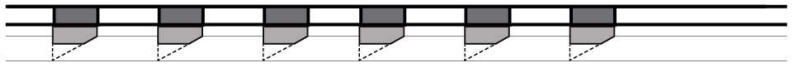
- Minimal shading
- Maximise daylight

North Façade









- Minimise solar gain from hot afternoon west sun from vertical shading
- Reduce spacing of vertical cladding to increase shading

West Façade

Entrance Reception


Typical Office Floor

The Ev0 Building Didsbury

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Upfront carbon

- This is the total carbon generated to produce a built asset, including emissions caused by extraction, manufacturing, transportation and assembly.
- 124kg C02e/m2 of the gross internal area (GIA) when taking carbon sequestration into account. 516kg CO2e/m2 (GIA) without taking sequestration into account, which is 14% lower than the 2020 LETI design target of 600kg CO2e/M2
- The Whole Life Carbon assessment for the development is currently calculated at 871kg C02e/m2 (GIA), below the RIBA 2025 target of 970kg C02e/m2 (GIA), with the ambition of meeting the RIBA 2030 target of 750kg C02e/m2 (GIA) during design development.

Operational carbon

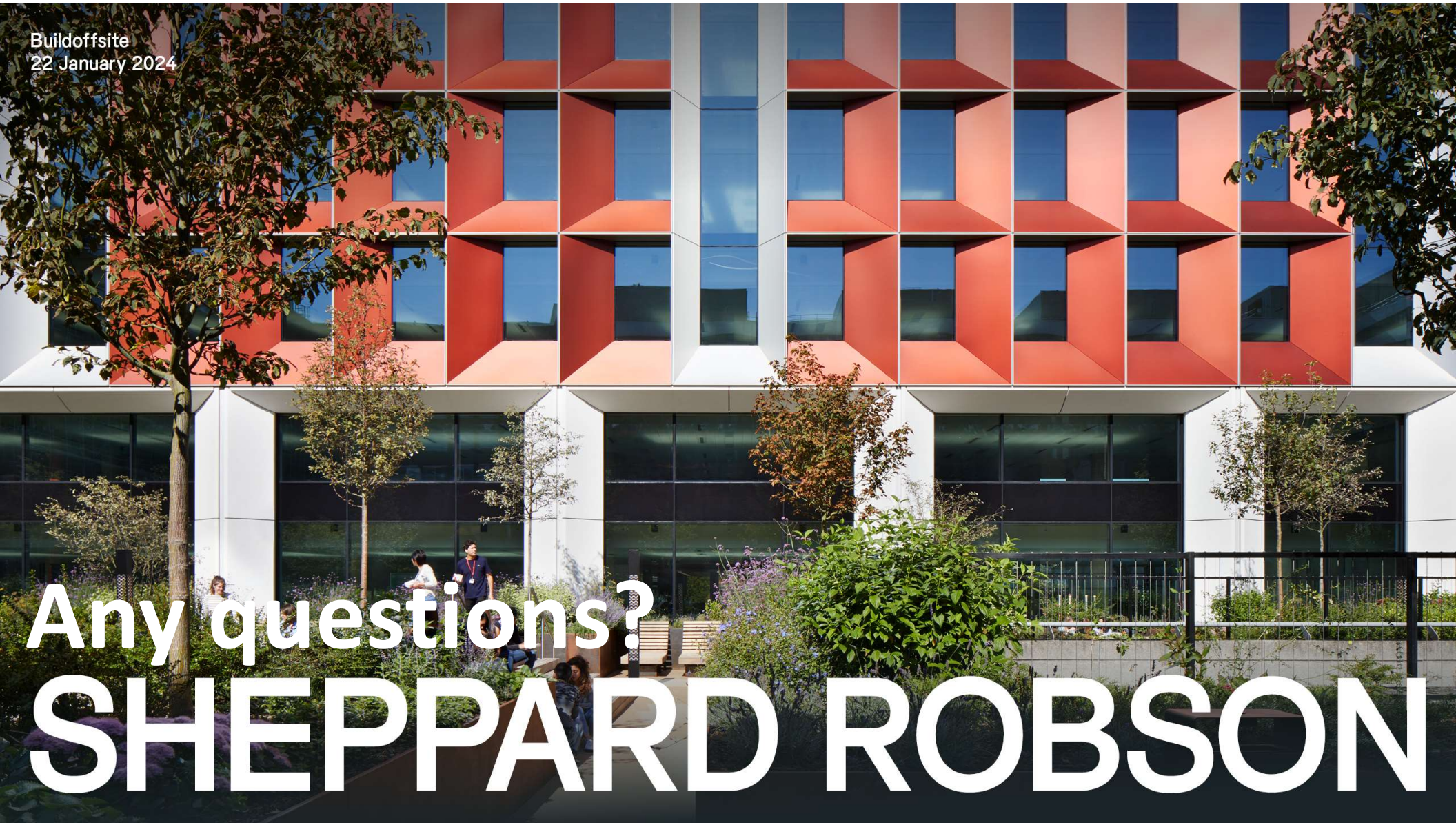
- The base building operational energy use has been calculated at 28kWh/m2/year (GIA), which is slightly below the UKGBC's Paris Proof Target of 30kWh/m2/year (GIA).
- Occupier energy has been assumed at 35kWh/m2/year (NIA) in line with the UKGBC's Paris Proof Target, whole building energy intensity is at 54kWh/m2/year (GIA), again slightly below the UKGBC's Paris Proof Target of 55kWh/m2/year (GIA).
- If the onsite generation is included, i.e. if only energy demand imported from the grid is assessed, the operational energy demand for the building is calculated at 5kWh/m2/year (GIA), The remaining energy demand of the building will be met by green energy generated from Bruntwood's co-operative wind farm.

Net-zero Carbon

- Re-using an existing structure would save 40% embodied carbon
- Form factor is hugely important
- SFS with punched windows preferable to curtain walling
- Efficiency is key, i.e build with less
- Reducing peak loads is key - i.e cooling
- Reducing cost can be associated to reducing carbon
- Exposed timber structure minimises need for finishes and adds tenant appeal
- Design programme needs to account for iterative design process

Lessons Learnt


Co-created
People-centred
Precision-made


Buildoffsite
22 January 2024
Any questions?
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Carbon tracking and calculation

16 January 2024

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