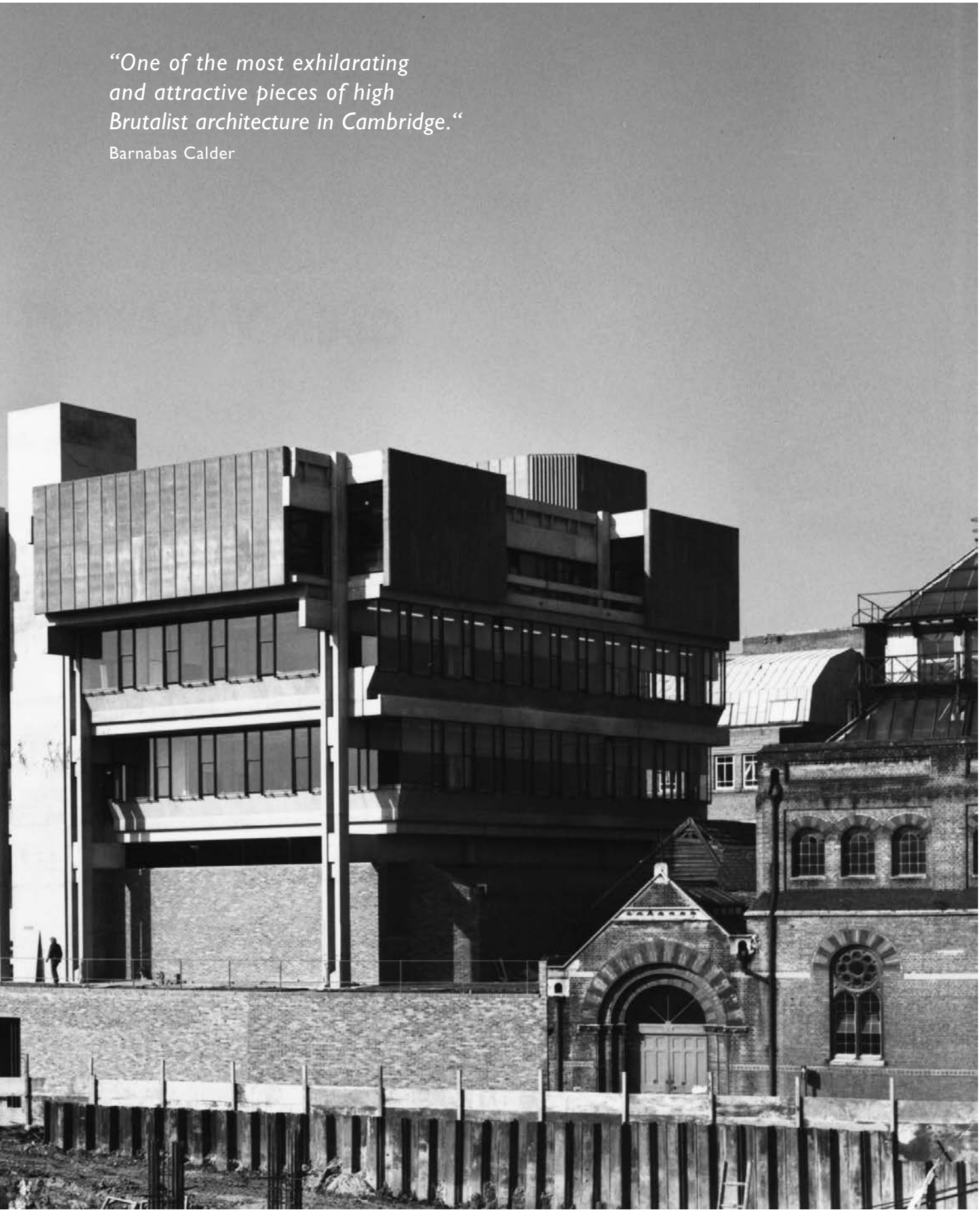
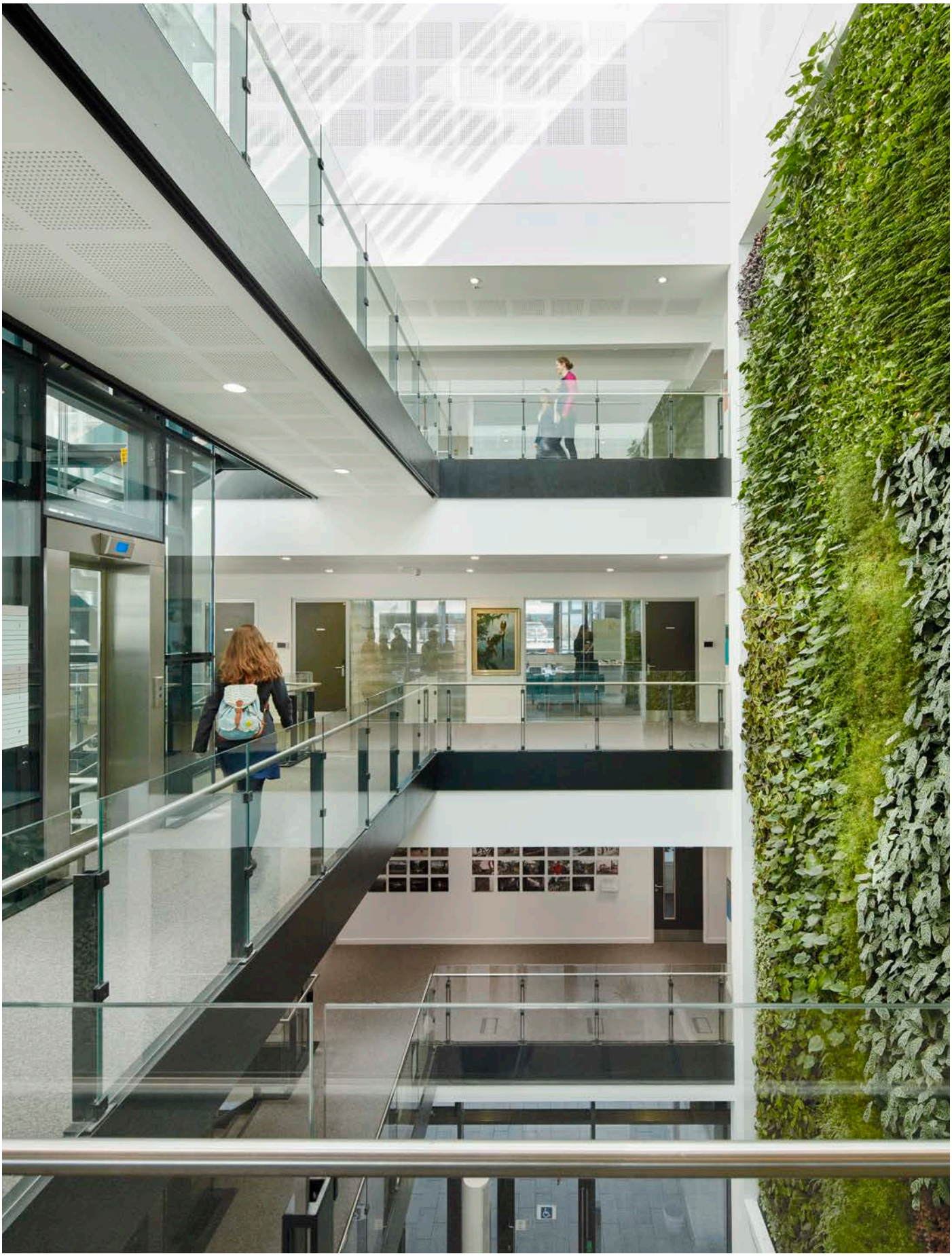
The David Attenborough Building
University of Cambridge

Nicholas Hare **Architects**

"One of the most exhilarating and attractive pieces of high Brutalist architecture in Cambridge."

Barnabas Calder



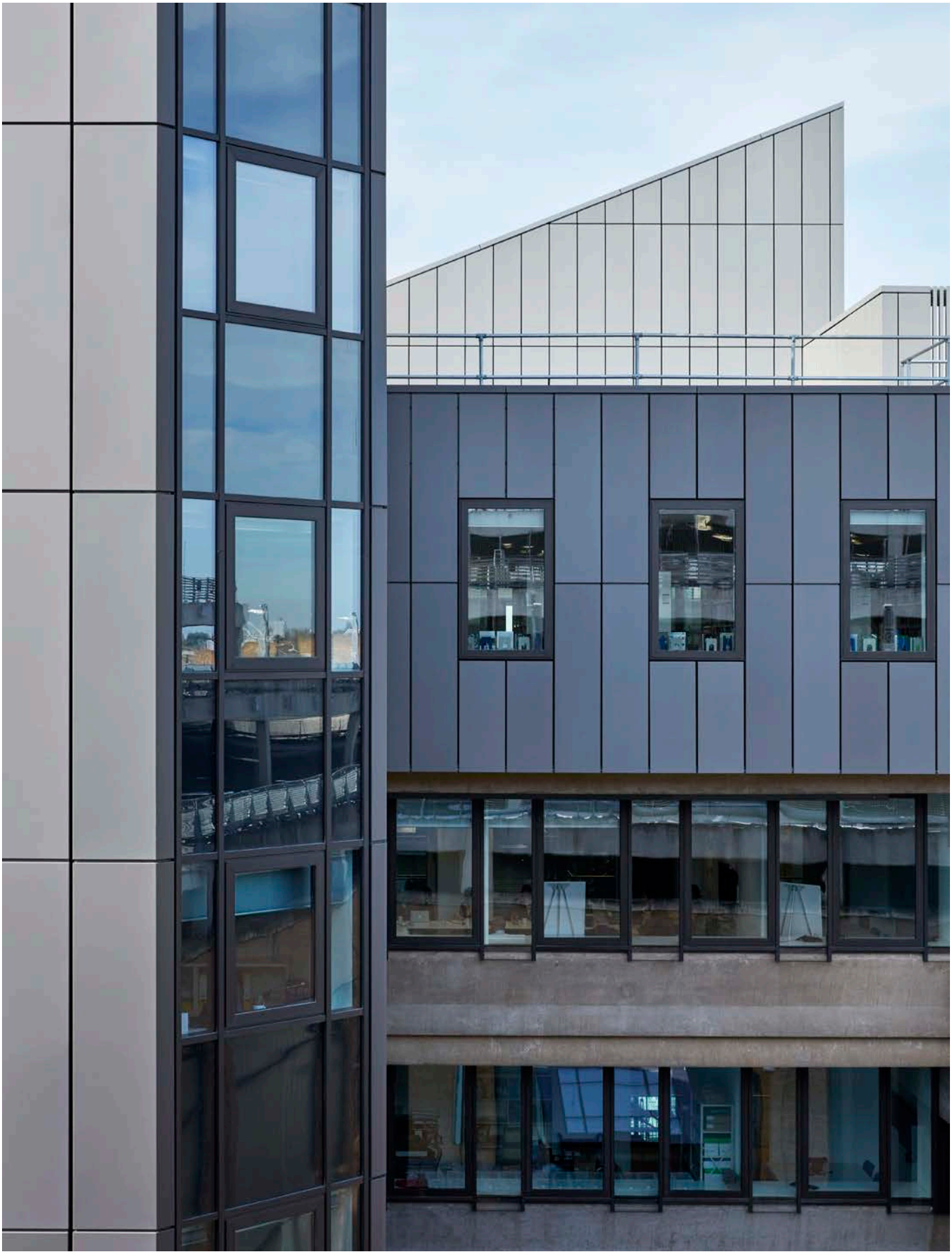


The reinvention of a Brutalist icon

Designed in the 1960s by RIBA Gold medal winner Sir Philip Dowson of Arup Associates, The David Attenborough Building is recognised as a Brutalist icon. Originally described by Pevsner as "a drama of violence", more recently it has been celebrated by architectural historian, Barnabas Calder as 'one of the most exhilarating and attractive pieces of high Brutalist architecture in Cambridge'.

Despite this iconic status, the Arup building, as it was known then, shared the same problems of much of the university estate built at this optimistic time when energy was cheap: no insulation, large areas of single glazing, spectacular cold bridges and deteriorating concrete. For the University, the building was one of their worst energy performers yet also one of their greatest property assets: 16,000m² of valuable real estate in the heart of the City of Cambridge. The large, deep floorplates and huge spans combined with the extensive glazing also meant that the building had the potential to provide highly flexible space and this together with a determination not to squander such an enormous volume of embodied energy led to the decision to refurbish rather than demolish.

Dowson's vision assumed that the building would be part of a much larger plan involving the creation of a grand podium linking the University and the City. The Arup Building was the only element of that vision to be implemented and so had an awkward relationship with surrounding buildings and levels. One of the principal aims of the project was to attempt to address some of these residual contextual problems – the lifted, inaccessible podium with its many level changes, the hidden entrances and the unwelcoming face presented to the City.



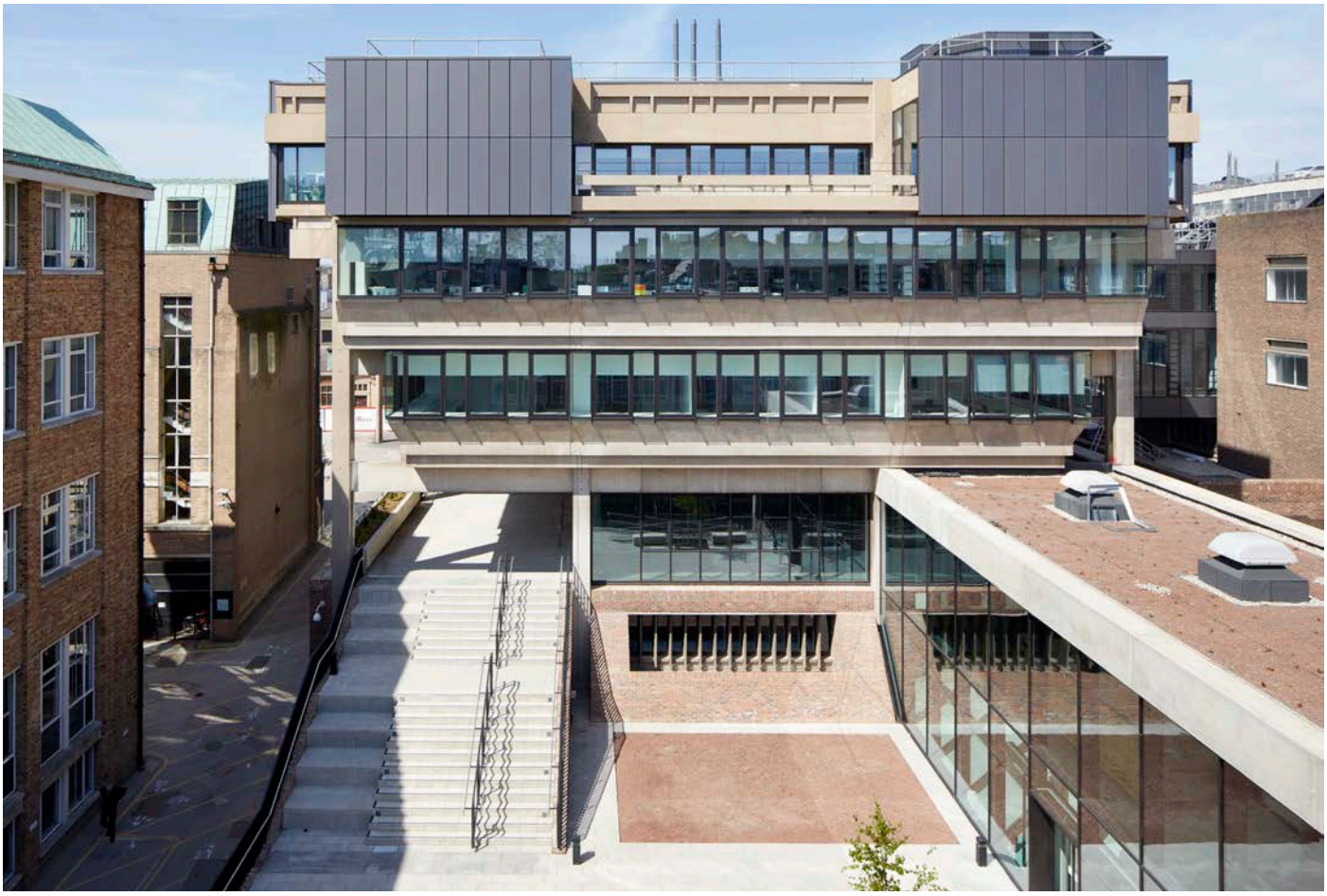
The brief

Originally built to house large scale laboratories and workshops, the building also included a 500-seat lecture theatre and an internationally renowned Museum of Zoology. It was decided that these should be retained and used as a nucleus for the creation of a multi-disciplinary campus for conservation research.

Although primarily a world-class academic resource, the Museum of Zoology had always been open to the public but footfall was low because, buried in the body of the podium, it was so hard to find. A key objective of the brief was therefore to raise the public profile of the Museum and enable it actively to engage with the public through a series of new and innovative spaces. These were to include remodelled galleries, interactive education and exhibition spaces, a cafe and a highly visible, inspiring new entrance

The idea of a conservation campus was underpinned by a unique strategic collaboration between the University and the Cambridge Conservation Initiative (CCI), a partnership of leading conservation organisations committed to the preservation of habitats and global biodiversity. It was fundamental to the whole concept of a collaborative campus that the building be radically re-organised to provide the kind of space that would enhance interaction and allow this partnership to flourish. It was also important to this group of like-minded users that the refurbished building would reflect their own specific sustainability objectives. These were inspired by their own research and the desire to occupy the building in an environmentally responsible way.

The brief was therefore not a straightforward refurbishment – rather a complete reinvention of this twentieth century masterpiece to meet the demands of the new and future uses. A separate challenge was to explore how this seemingly unpromising legacy of 1960s optimism could also become a sustainability exemplar within the constraints of a standard university budget whilst also preserving the integrity of the original design.



Adapting the building to new uses

The design adapts the building to its new uses through a series of simple but bold architectural interventions that match the scale and confidence of the original design intent.

A world class museum

A dramatic new entrance to the Museum showcases a fin back whale skeleton and provides an exciting introduction to the new exhibitions and education spaces whilst giving the Museum a visitor-friendly identity. In addition, a new south facing forecourt turns an unwelcoming and inaccessible podium into a sunny and enjoyable place where visitors can gather. New external lifts take visitors up to the main podium – now a largely level surface – which also acts as a terrace for the new café.

The café links to the Museum entrance via a high-level gantry that allows families to walk the length of the whale and enjoy an elevated view of exhibitions in the foyer space. Under the tail of the whale, a spiral stair leads down to a dedicated children's education room whilst similar spaces linked to the galleries themselves provide seminar and demonstration spaces for visitors, students and academics. All back of house facilities including conservation and departmental laboratories have been refitted and new state-of-the-art stores with environmental conditions specifically matched to the specimens have been created from the old machine rooms within the podium.

Reclaimed slate artworks by Ackroyd and Harvey have been integrated into the building fabric to engage the public and lead visitors from the City into the building. The end wall of the Museum extension also incorporates hidden habitats for bats, birds and insects.

"A state-of-the-art museum in a wonderful building dedicated to studying and maintaining biodiversity."

Professor Paul Brakefield, Museum Director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The Cambridge Conservation Initiative

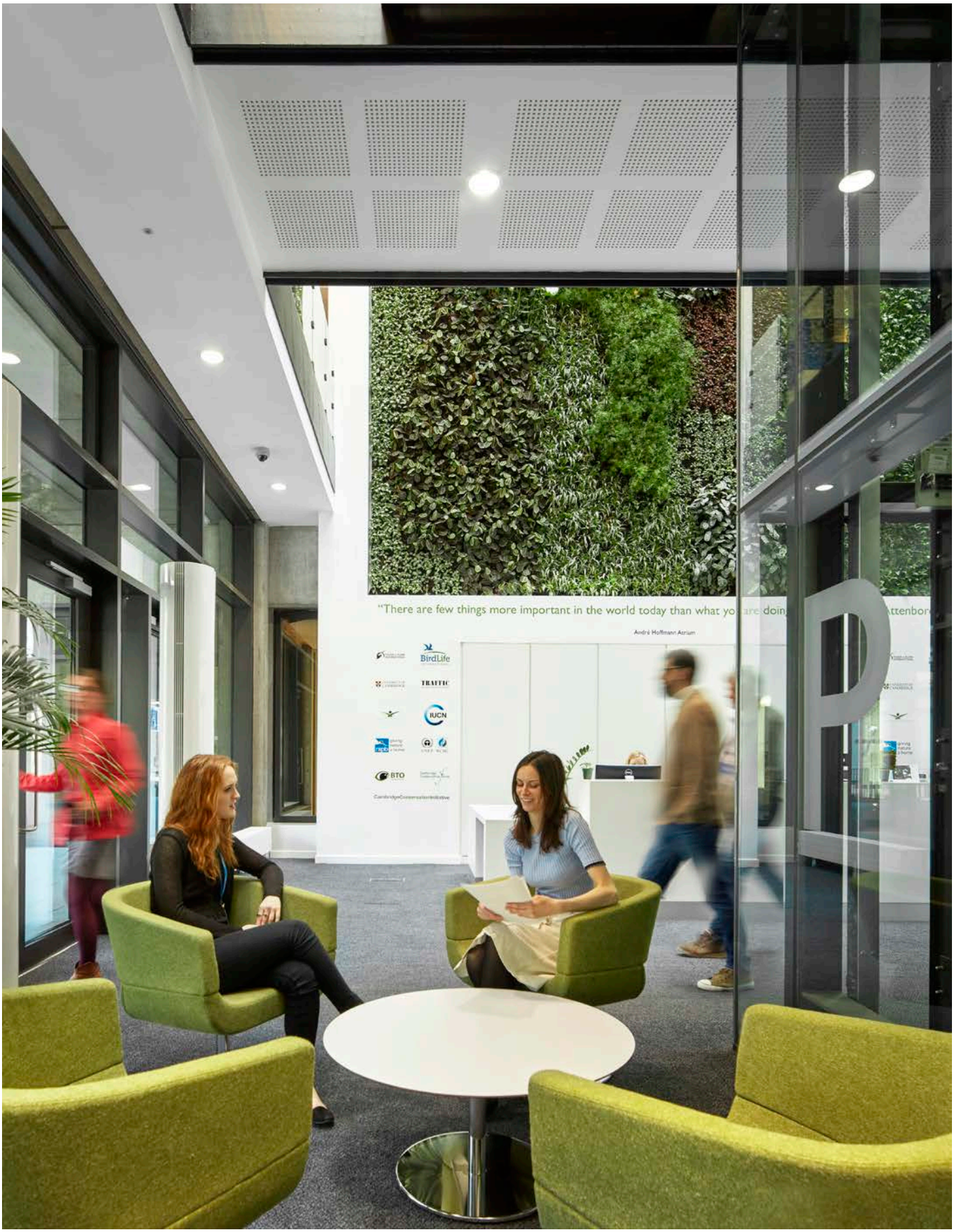
A dark and windswept undercroft has been replaced by a transparent and welcoming entrance for the CCI that addresses both the City and the University. A full height atrium unites the three upper levels of the building that float above the podium and creates a collaborative hub at the heart of the building. Views across the atrium and the cluster of shared meeting places around it mean that opportunities for encounters and interaction between the partners are much enhanced. Within the atrium a living green wall irrigated by rainwater and shaded by photovoltaics set into the rooflight above acts a reminder of CCI values.

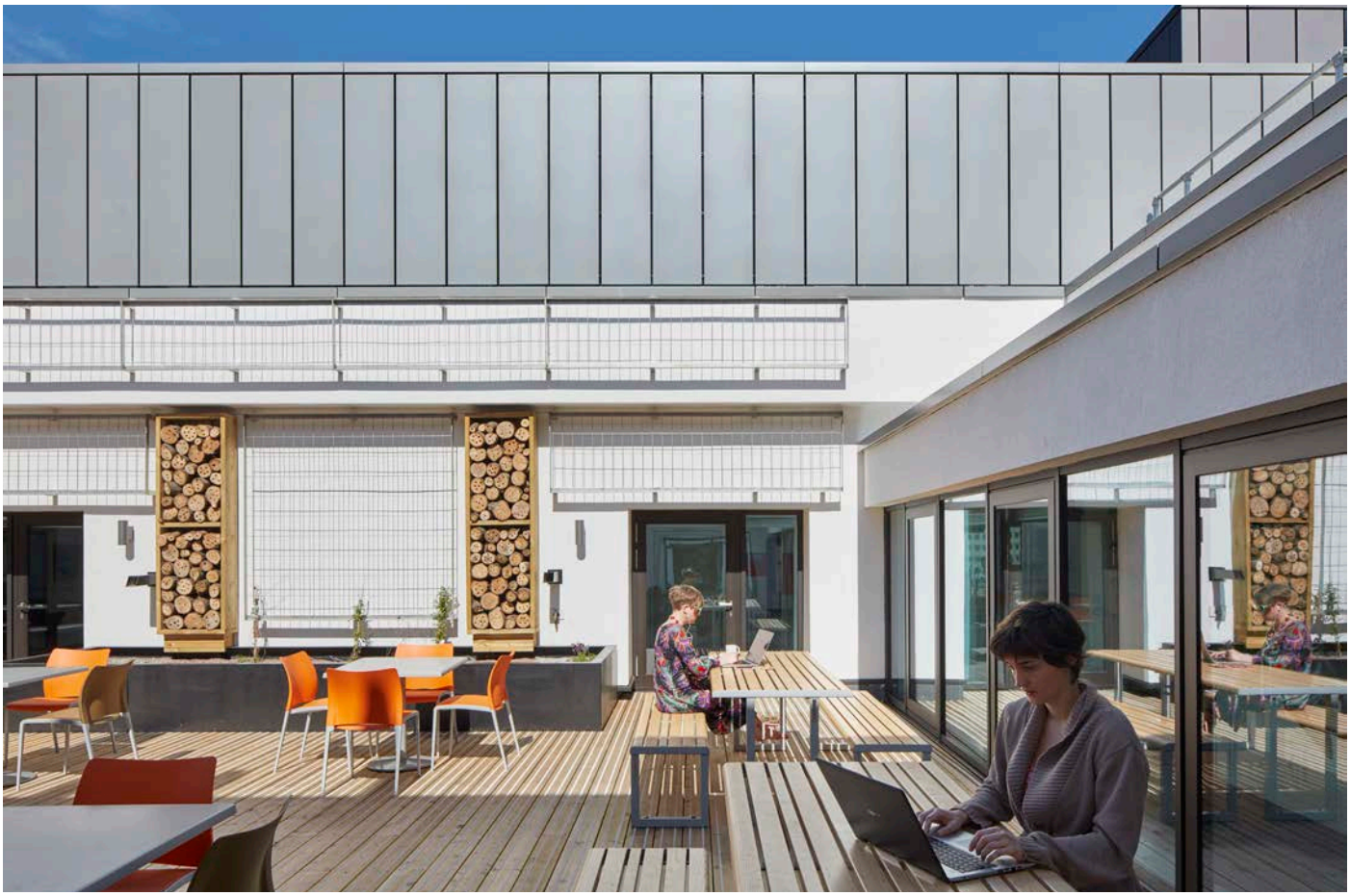
In order to maximise the potential of natural daylight and ventilation within the deep floorplates, offices and meeting spaces have been located in the centre of the floorplates away from the perimeter. The research areas are mostly open plan to facilitate the easy reconfiguration of research groups for specific projects and encourage collaboration. Workshops with the different organisations and the academic groups were held at all stages of the project to explore and develop the kinds of space that would both preserve the identity of each partner whilst also enabling creative interaction. The balance of space types with its rich and varied mix of meeting-space and different working environments has been extremely successful. The light and airy interiors have made the campus a popular and enjoyable place to work.

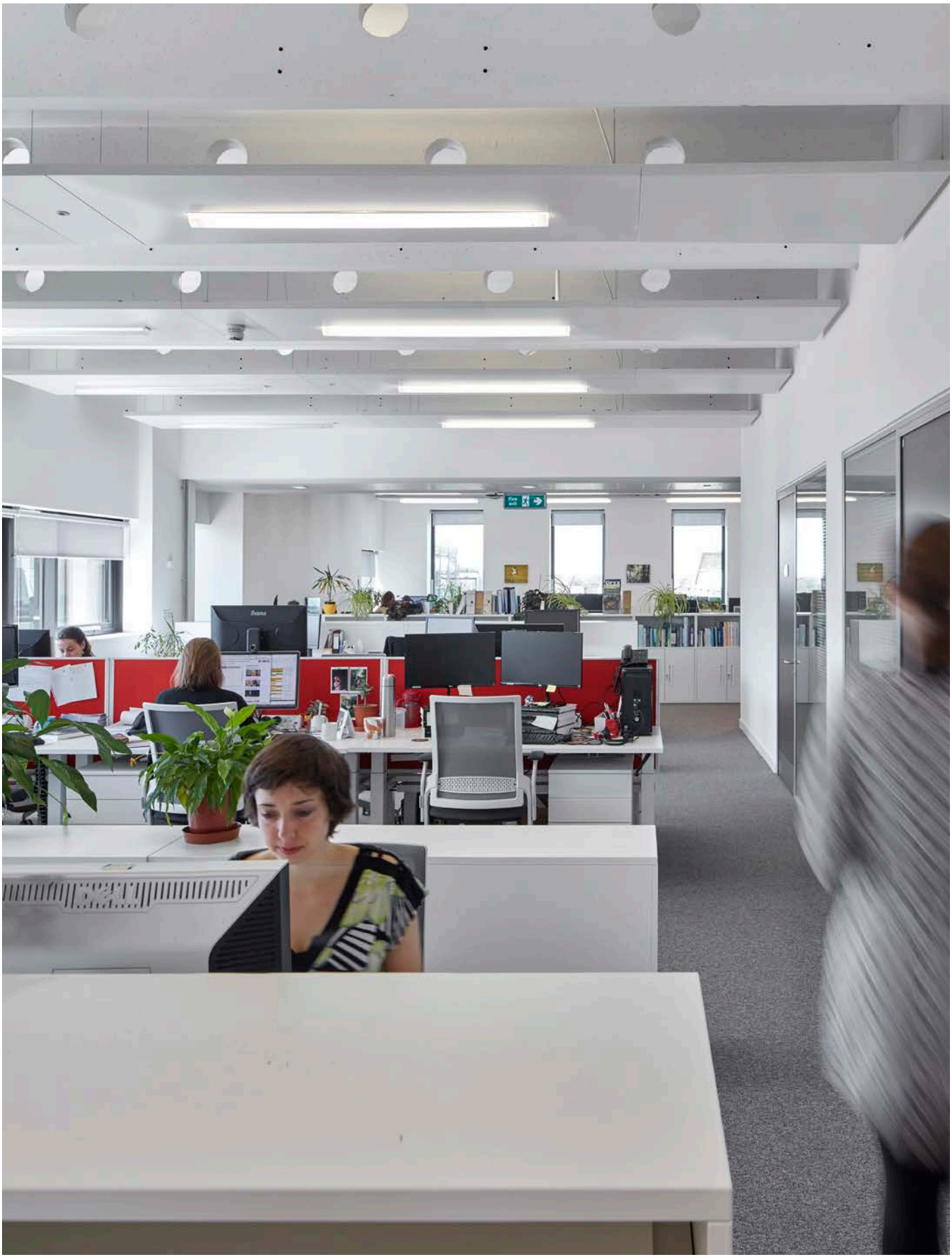
The new, insulating green roof which has replaced the old felt-clad lightweight structure is used by the CCI as a living laboratory to monitor biodiversity in an urban setting. Incorporating photovoltaic arrays, it also forms part of a "rain garden" strategy that irrigates planting and temporarily stores rainwater in a reservoir below the rooftop courtyards. These courtyards provide further informal meeting space for CCI as well as additional habitat areas. The towers have been adapted to provide peregrine falcon ledges and swiftboxes placed behind the vertical louvres. Webcams provide live feedback to the CCI on how the building is managing to create new habitats within the city.

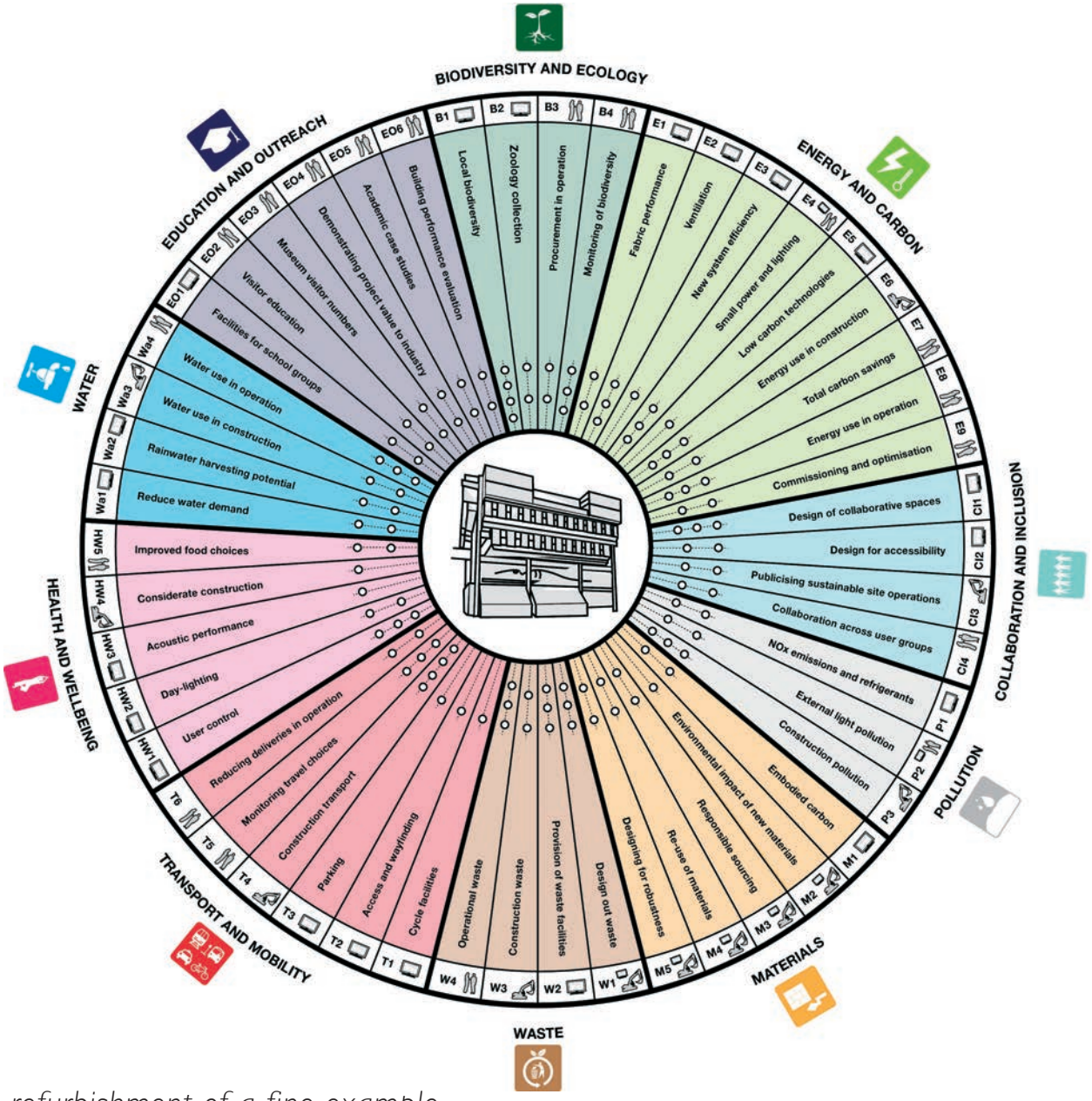
"Nicholas Hare Architects have been inspirational to work with... they have consulted end users widely but with a clear focus, championed new ideas, fostered collaborative working and built enthusiasm and ownership for the project across key stakeholders while keeping the project on time and on budget."

Dr Mike Rands. Director, CCI


"There are few things more important in the world today than what yo
André Hoffmann Atrium
BirdLife
TRAFFIC
IUCN
BTO







"The refurbishment of a fine example of 1960s architectural brutalism will demonstrate the highest levels of environmental sustainability and be an exemplar of how to enrich and conserve biodiversity in an urban setting."

Cambridge Conservation Initiative

A sustainability exemplar

A bespoke environmental assessment framework

The focus on biodiversity is an important element of the bespoke sustainability framework developed for the project which allowed project specific sustainability objectives to be identified.

The framework, now being developed for use on other projects by the University, aimed to reach beyond BREEAM. At that time BREEAM did not reward the retention of existing buildings or measure the outcomes of the design in use – a key part of the soft landings process adopted. Ambitious, project specific targets across 10 headline themes and 50 sub-themes were developed through facilitated workshops with all parties – the University, building users, facilities managers and the project team.

These were summarised in a comprehensive building handbook setting design, construction and post occupancy targets which were (and are being) independently monitored by the sustainability consultant.

Headline targets included a 40% reduction in operational carbon emissions, 30% reduction in water use per person and 60% total roof coverage for biodiverse green roofs.

Methodology

Passive design principles make best use of the building's existing assets. The high levels of existing concrete combined with new phase changing materials to the soffit of the lighter-weight roof structure were used to promote a natural ventilation strategy involving night cooling. New double-glazing respects the original fenestration (rhythm, frame dimension and distinctive over-sailing bottom edge) preserving the natural light levels but enormously increasing the natural ventilation. 70% of the building is naturally ventilated.

A thermal strategy was developed that identified the many types of construction and assessed how each could be updated to contribute to an overall improvement in performance. By proposing more radical treatment to less architecturally sensitive areas it was possible to minimise the treatment to others – preserving the architectural quality of key areas like the Museum.

Externally, the concrete has been carefully cleaned and restored without any artificial finishes. The lead cladding has been replaced with more durable and longer life lead-grey anodised aluminium. Inventive engineering has allowed the existing lightweight roof to be replaced with a heavier, biodiverse green roof which also attenuates rainwater run-off.

All building services were replaced. New ventilation ductwork and plant with heat recovery and low specific fan powers serves areas that cannot be naturally ventilated such as the Lecture Theatre and the Museum. Low-energy lighting with occupancy detection and daylight dimming assist in minimising artificial light in occupied areas. New boilers and a combined heat and power (CHP) provide an efficient source of heating, hot water and power to the building. The photovoltaics on the roof and within the main rooflight have the potential to generate 16.5kW of electricity.

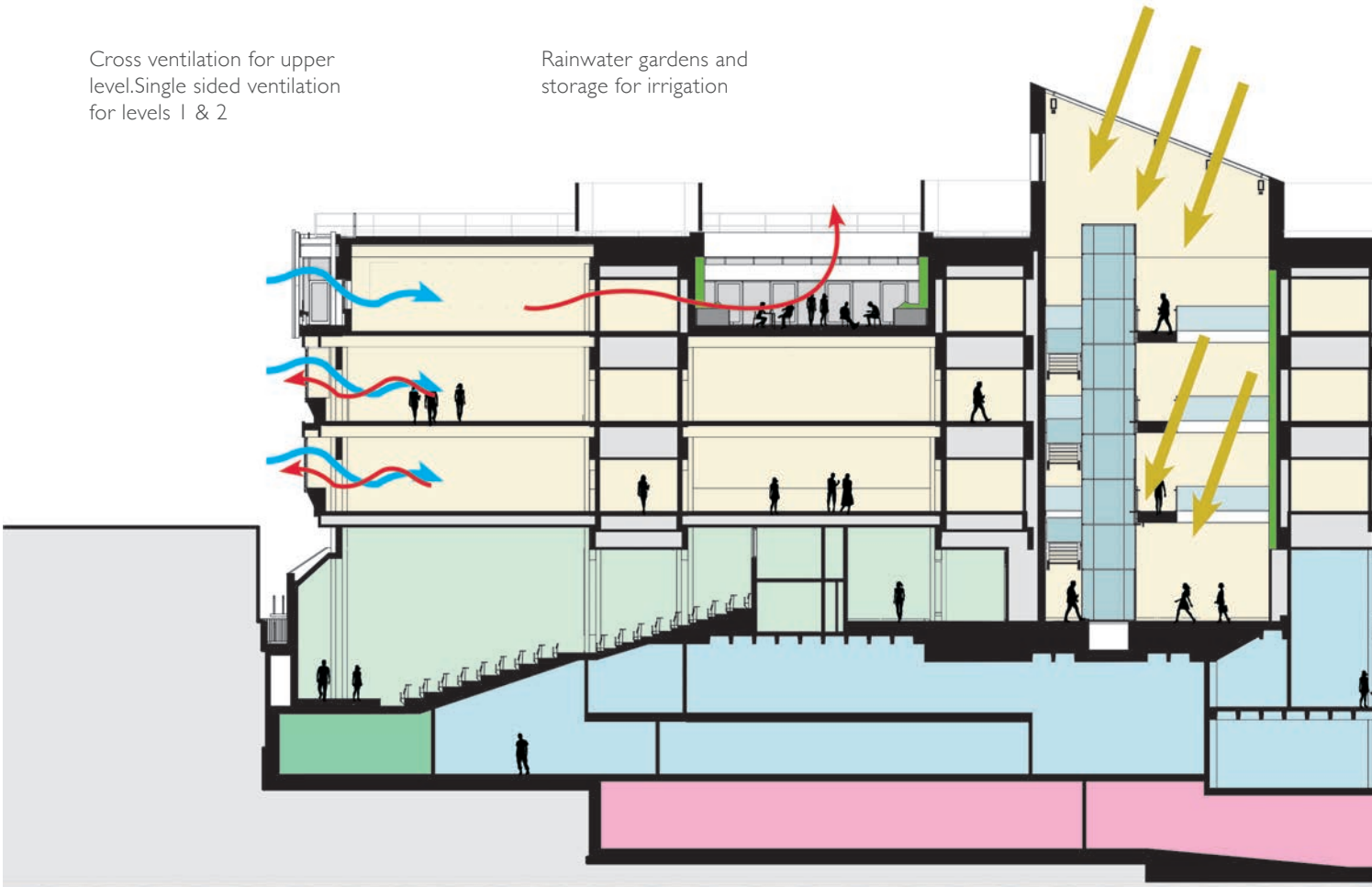
Natural ventilation of all perimeter office bays

Green roof covering 30% of available roof area

New glass atrium provides daylight deep into floor plan (PV provides glare control)

Cross ventilation for upper level.Single sided ventilation for levels 1 & 2

Rainwater gardens and storage for irrigation



Double stacked cycle racks and showering facilities

Thermal mass of concrete to reduce overheating

Downpipes for site wide rainwater harvesting

Low energy ICT infrastructure to reduce overheating

Photovoltaic panels for electricity generation

Habitats for bats, birds and insects – CCTV observation

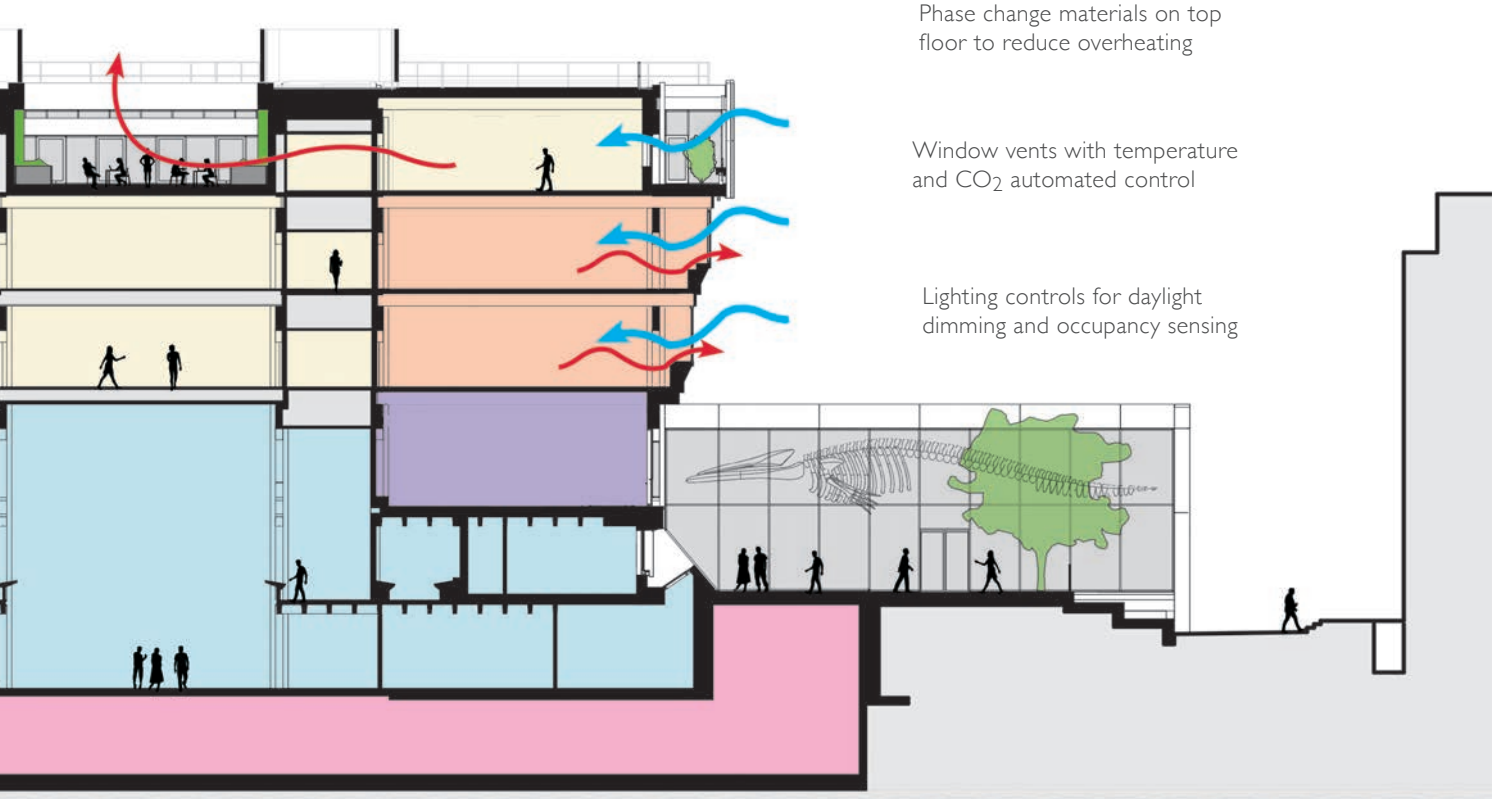
Combined lighting & acoustic raft for acoustic control and low energy consumption. LED lighting in corridors.

New double glazing and improved air tightness

Phase change materials on top floor to reduce overheating

Window vents with temperature and CO_2 automated control

Lighting controls for daylight dimming and occupancy sensing



Internal insulation going beyond 2010 Building Regulations

CHP supplying heat, power and hot water.

Energy and water sub-metering per floor. Energy displays in foyer of building

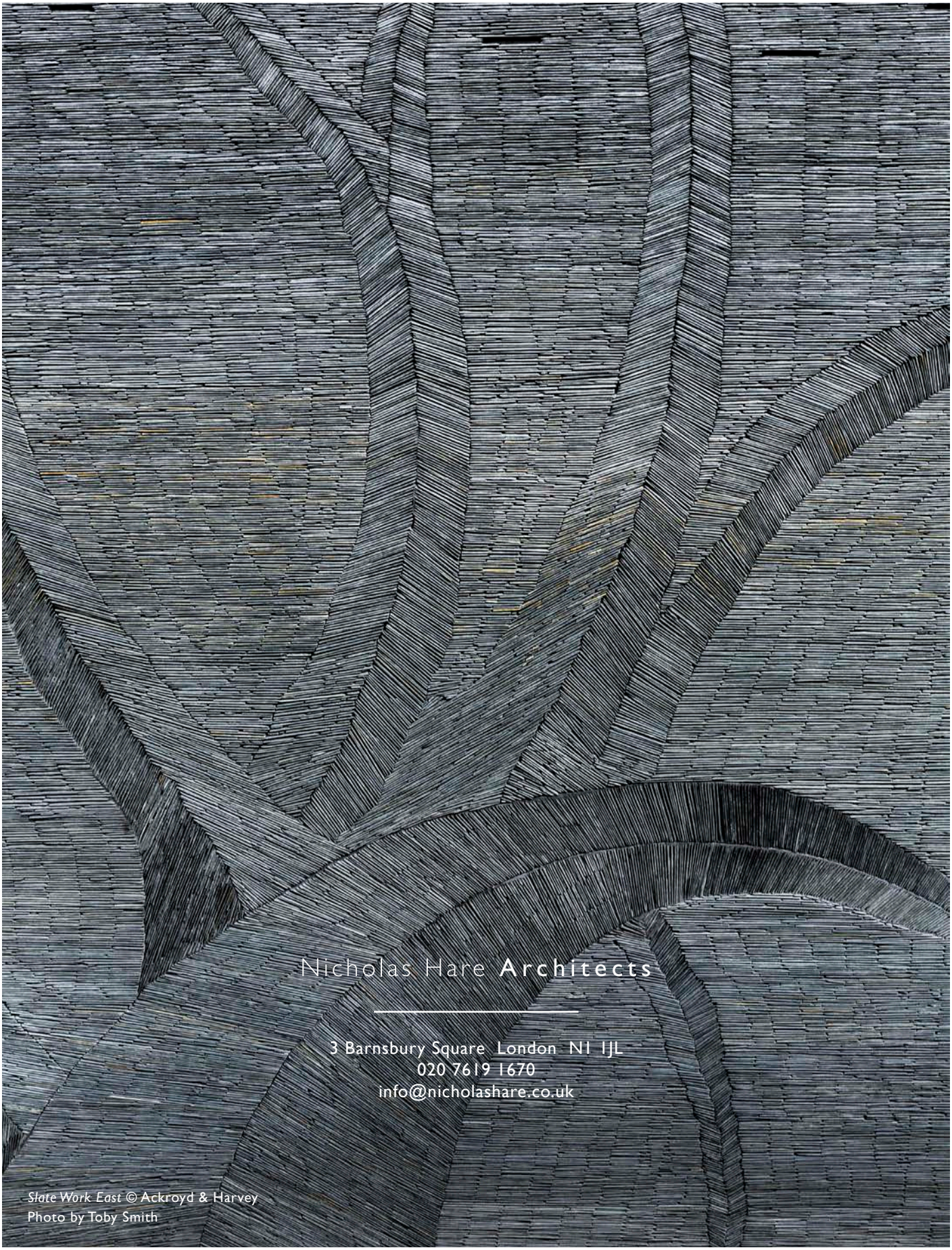
Outcome

This approach has resulted in a 31% reduction in regulated CO_2 emissions over Part L2b 2010, now equivalent to a 25% reduction over 2013 regulations. The building now achieves a B46 EPC rating in comparison to estimated benchmarks for new-build of B37 and existing building stock of D99 demonstrating a significant improvement in rated energy performance.

It is estimated that over 82% of the building's embodied carbon has been saved through refurbishment works. The building is extensively metered and it is hoped that this data will provide valuable lessons for the design team and the University. More importantly it will allow the building users to modify their own behaviour to maximise the sustainable potential of the building and reduce the "performance gap" between design and outcome.

Project team:

Project management:	AECOM
Cost planning:	AECOM
Structural engineers:	AECOM
Environmental engineers:	BuroHappold Engineering
Sustainability consultant:	BuroHappold Engineering
Fire engineer:	BuroHappold Engineering
Biodiversity & infrastructure:	The Green Infrastructure Consultancy and Robert Bray Associates
Contractor:	Kier Construction



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Slate Work East © Ackroyd & Harvey
Photo by Toby Smith