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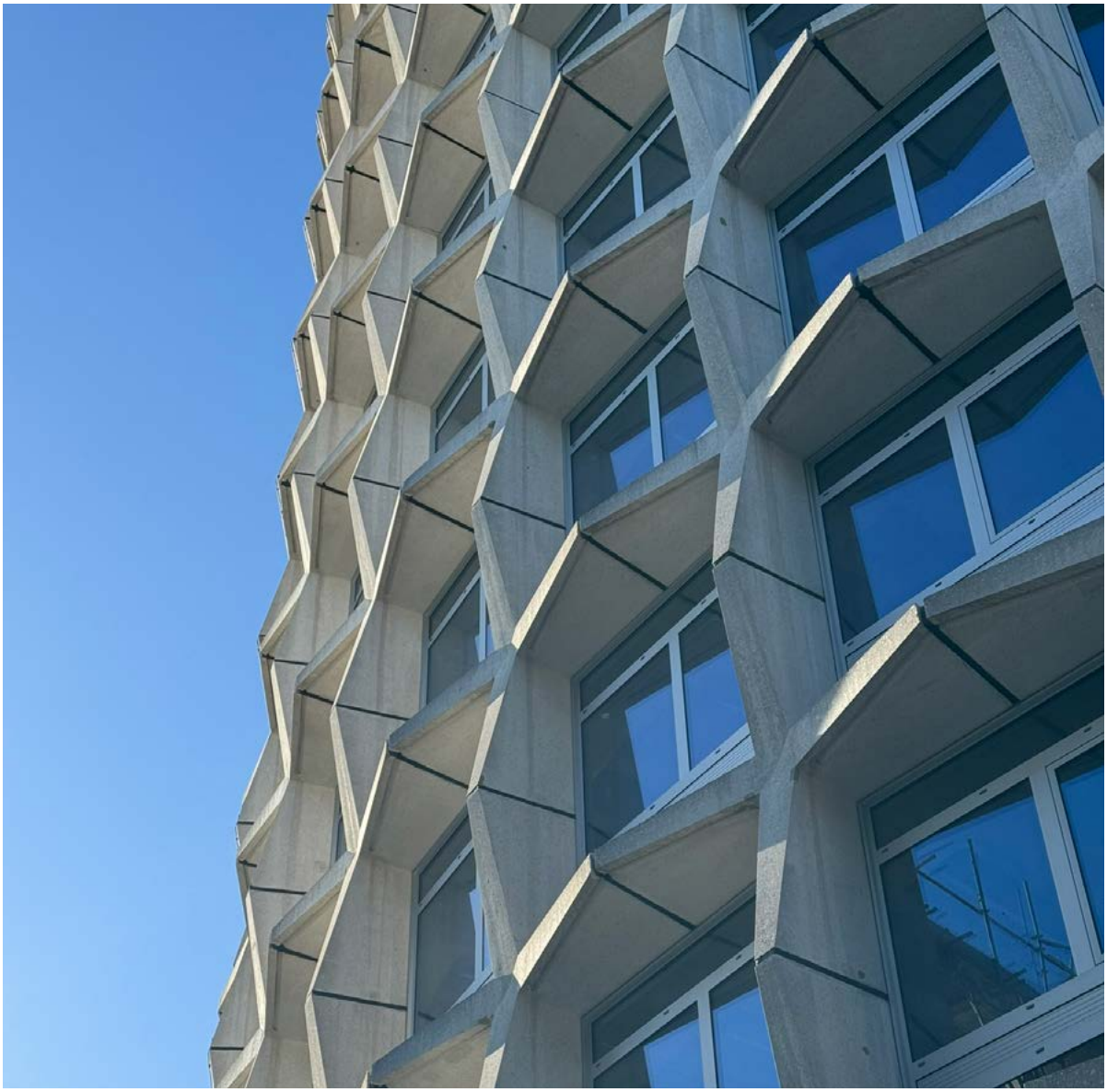

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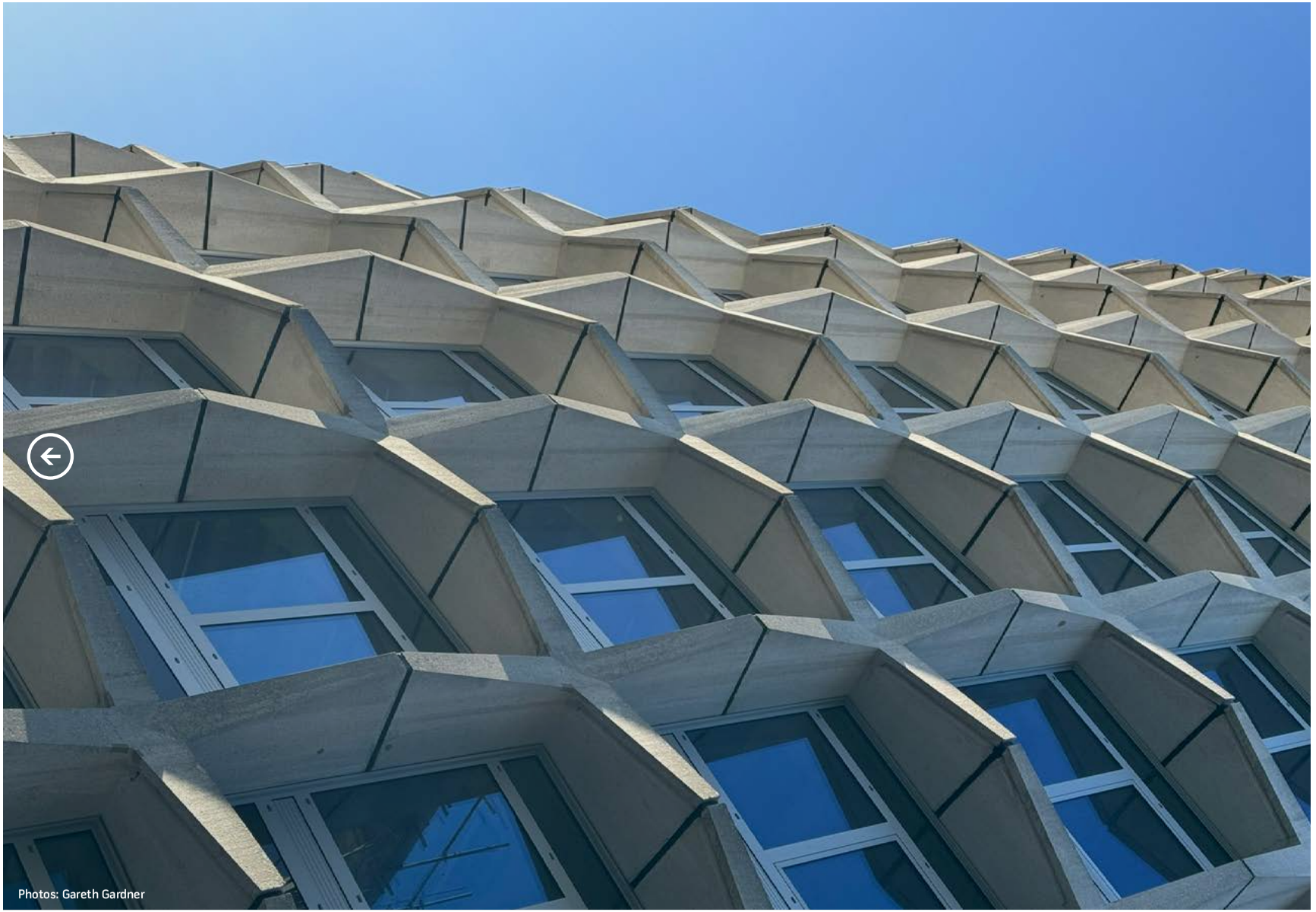
Squire & Partners helps an icon of sixties London to get back in the groove

HOUSE OF EGYPT →
The story behind the precast hieroglyphs at Paris' international campus

CUT OUT AND KEEP →
Extracting and reusing structural elements for a more circular world



Photos: Gareth Gardner

THE NEW SPACE AGE

The rebirth of 1960s icon Space House as a 21st-century office inventively reuses both its pioneering hybrid structure and its precast cladding. Nick Jones reports

Completed in 1968, Space House is often viewed as the little brother of Centre Point. Standing like retrofuturistic bookends at either end of London's Covent Garden, the two office towers were both designed by Richard Seifert and George Marsh for developer Harry Hyams, their shared DNA evident in the geometric grid of their structural precast concrete facades.

ABOVE
Squire & Partners has added two storeys to the tower – an extension that involved temporarily removing the top ring of precast panels and inserting a new layer below

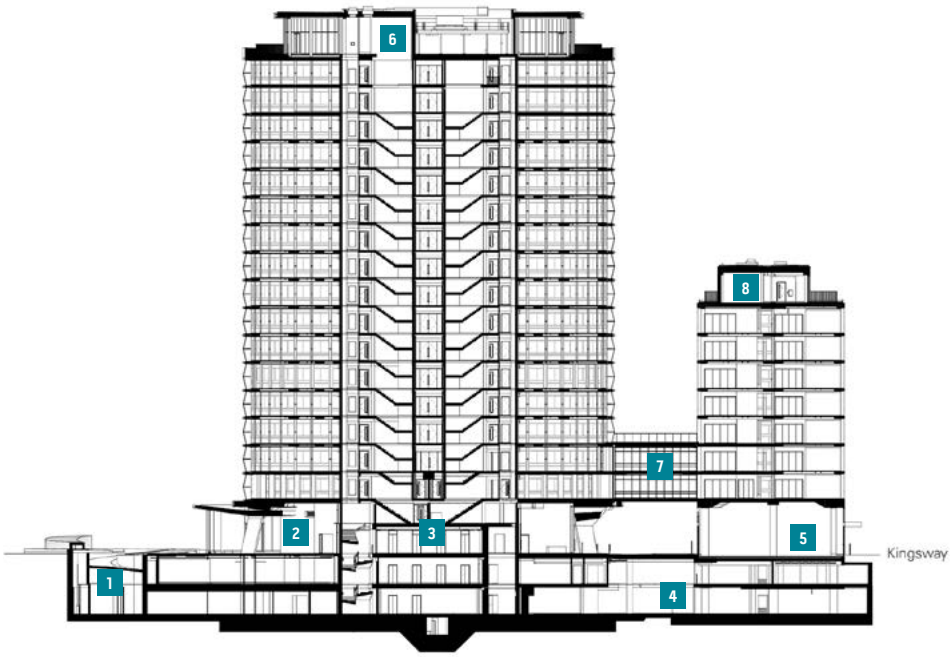
But whereas Centre Point was recently retrofitted as a residential tower (CQ 261), Space House has taken a different path. A major renewal project led by developer Seaforth and architect Squire & Partners has both restored the original vision for the grade II-listed tower and adjoining seven-storey block, and updated it for a digital, more carbon-conscious age. Having spent much of its life as a rather dowdy headquarters for the Civil Aviation Authority, the workplace inside Space House has been thoroughly modernised, complete with WiredScore Platinum, Fitwel and BREEAM Outstanding ratings – the latter a first for a listed building in London.

It has grown too. Squire has added two storeys to the tower and an extra level to the block, creating panoramic offices, a "clubhouse" and rooftop terraces. A double-height 1,500m^2 event space has been carved from the vast basement car park, and lift capacity increased by 50%. This ability to discover and create new space in Space House owes much to the inherent strength of the existing frame – a pioneering hybrid of in-situ and precast concrete, which required little additional stiffening.

"We could strip away and add these different elements," says Chris Railston-Brown, director of development at Seaforth. "That's what makes it so suitable for

THE BUILDING HAS GOT REALLY STRONG BONES. THAT'S WHAT MAKES IT SO SUITABLE FOR RETROFIT

BELOW
In all, 48 exact reproductions of the original cruciform units were designed and manufactured



SECTION

1. Bicycle ramp
2. Cafe / bar
3. Reception
4. Event space
5. Retail / restaurants
6. Rooftop terraces
7. Skybridge
8. Clubhouse

retrofit – the building has got really strong bones."

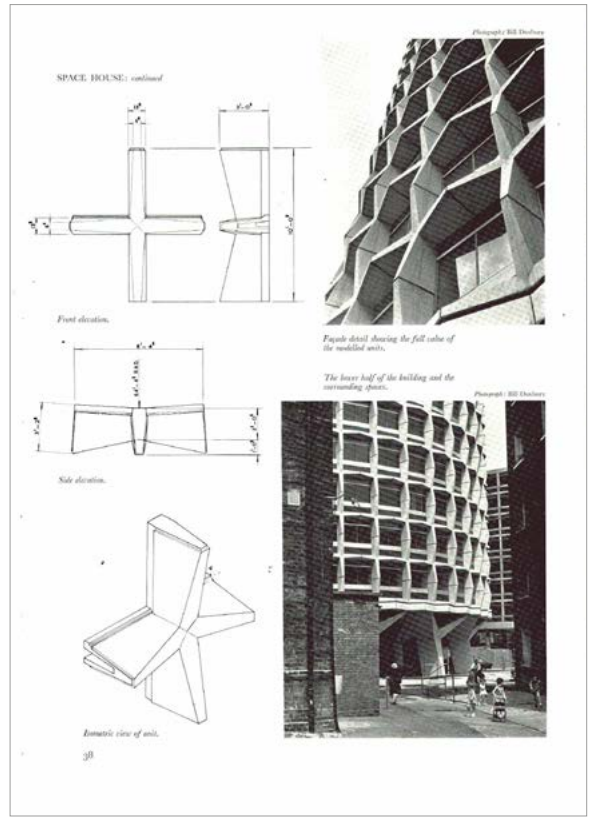
As with many similar retrofits, the project began with a trip to the archives. Handily, the structural engineer on the scheme, Pell Frischmann, had been responsible for the original building. "We were lucky to have almost a complete set of drawings which were really essential to understanding the form and behaviour of the structure," says Luke Riddoch, principal engineer at Pell Frischmann. "And we had the archive calculations, which gave us the existing loading constraints and the original design codes."

The archive showed that the circular floor plates consisted of a "bicycle wheel" of precast prestressed ribs – or spokes – made from high aluminium cement

(HAC) concrete. These act compositely with six main in-situ beams, also radiating from the centre, and a thin structural screed. Although typical concrete strength at the time was around 14MPa, the archive revealed that at Space House it ranged from 30 up to 55MPa on the precast units.

But, as Railston-Brown points out, "you still have to verify that what you've got is what you think it is". The only way to do that was by surveying the actual building, ranging from rebar scans to analysis of chloride content. A crucial assessment was the fire integrity of the slabs, which had been designed for 60 minutes of resistance but required 90 minutes to meet modern standards. Pell Frischmann also wanted to verify the condition of the precast ribs, as HAC concrete tends to become porous over time. This can lead to a reduction in strength, says Riddoch. "But our inspections determined that they

BELOW
Pell Frischmann's original hybrid structure of in-situ and precast concrete required little additional stiffening


SPACE HOUSE: continued

Front elevation.

Side elevation.

Isometric view of unit.

Façade detail showing the full value of the modelled units.

The lower half of the building and the surrounding spaces.

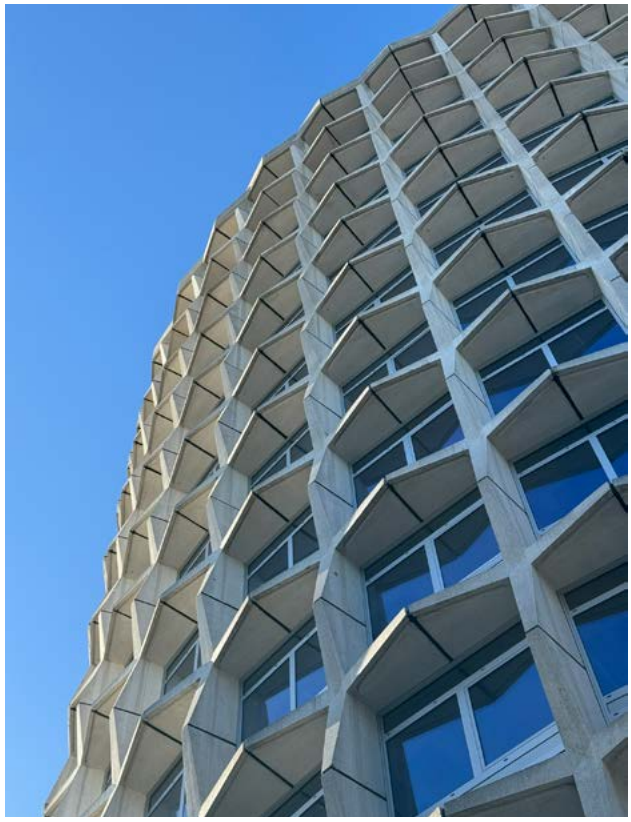
were generally in very good condition structurally, with very little sign of corrosion of the tendons."

The calculations were helped by the fact that office work is a lighter business these days. "Old offices were designed for live loads of about 5.5-5.8kPa because they had a lot of heavy equipment and stacks of large paper files," says Railston-Brown. "Now they're designed for 3.5kPa, so we were able to recalculate the live loads and then use that to increase the dead load on the tower itself."

Even with the structural capacity confirmed, the team still needed to convince Camden council of the virtue of extending a listed building upwards. Using more archive material – including Marsh's original watercolour designs and four early photographs from a 1967 issue of *Concrete Quarterly* – Squire made the case that the new floors would serve to reinstate the intended silhouette, which had been blighted by accretions of rooftop plant.

Following the same logic, the architects proposed a concrete structure, with one new level clad in precast panels precisely replicating the floors below, and a setback rooftop level providing space for terraces. "We argued that, in listed buildings, if something is broken, sometimes a facsimile is the right answer," says Squire partner Tim Gledstone. The plant would be rationalised, with much of it moved to the basement. Equipment that needed to be on the roof for energy-efficiency reasons, such as air-source heat pumps, could be concealed by the setback top floor.

ABOVE
Space House first featured in CQ in Autumn 1967. Archive photos from the magazine were used to help convince Camden council that the two-storey extension was in keeping with the original architectural intent



ABOVE
Each of the openings in the original facade was 3D-scanned – leading to the discovery that there were more than more than 100 different window sizes

In all, 48 exact reproductions of the original cruciform units were designed and manufactured, using data derived from archive drawings, 3D scans and material analysis of existing panels. In what may well be a first-of-its-kind reuse technique, the top ring of original T- shaped panels were removed, cleaned and repaired, and then reinstalled as the new building crown (see box, page 28). "We saw it as a chance to treat the building more like a living museum, where we could go back through the steps, and piece together the process of making the cruciforms," says Gledstone. "With such a rigorous modular design, there are very easy signposts to follow."

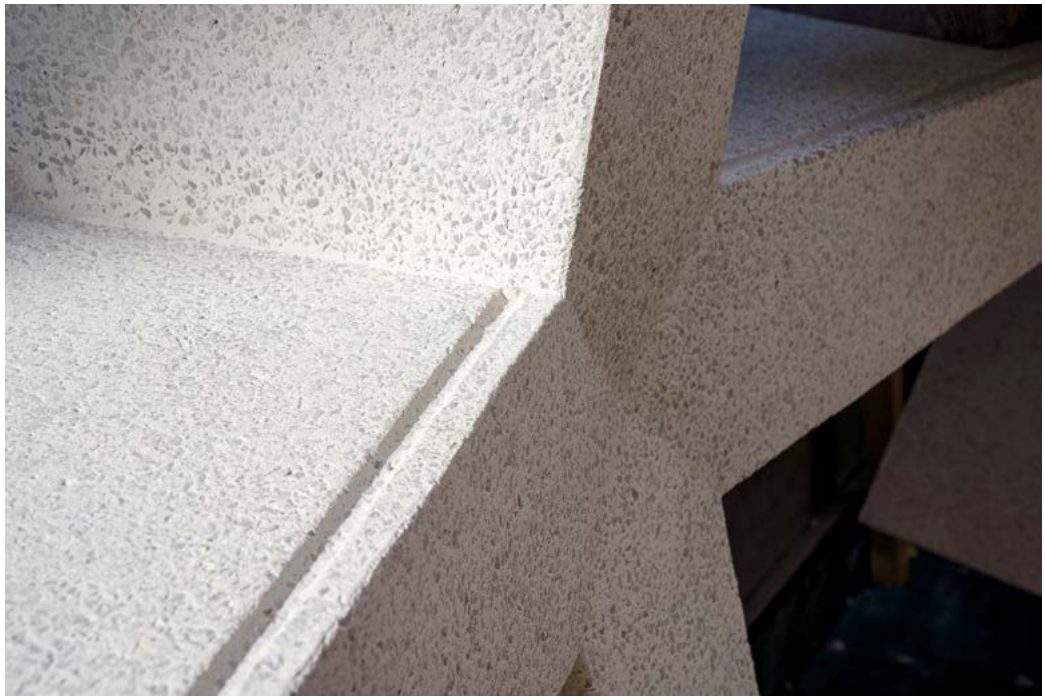
On the block, the setback clubhouse also has an in-situ concrete structure, with cladding replicating the precast tiles of the existing building. Here, the structural frame below required some strengthening, partly because the removal of a mezzanine at ground-floor level has reduced lateral stability. A transfer structure takes the load of the clubhouse down through the perimeter of the block, while the Y-shaped pilotis and the basement shear walls have been stiffened.

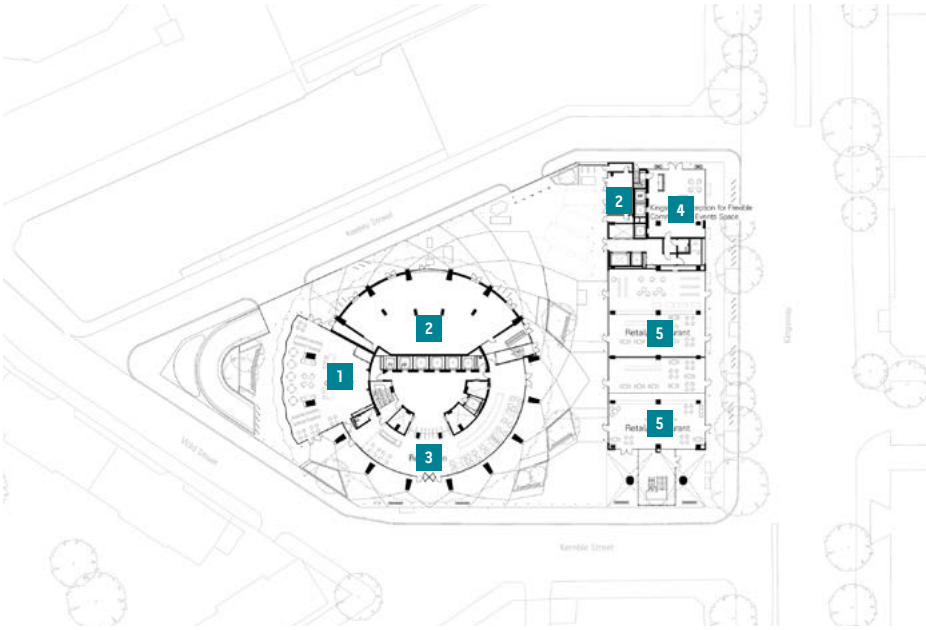
The existing precast facades were in good condition – as at Centre Point, these have just been gently cleaned using sodium hydroxide gel and hot water. Upgrading the tower's sliding windows to an energy-efficient

automated system posed more of a challenge. Each of the original windows had been made individually, resulting in tolerances of +/-20-30mm. "We 3D-scanned every single opening on the tower, and ended up with over 100 different window sizes," says Railston-Brown, in a process that Gledstone describes as "both very futuristic and pretty analogue". The windows were separated into six groups according to size. Each was given a barcode, with all of the scanned dimensions of its unique location and fitting requirements. The external detailing around the windows was then designed with a small tolerance incorporated to deal with the variety.

Internally, the modernisation also began with the bones of the building. False ceilings, installed when the CAA moved in, have been removed, revealing the "bicycle wheel" ceiling radiating across the circular, column-free floorplates. "The HAC has left a beautiful

BELOW
The surface of the replica cruciform units was grit-blasted to match the texture and finish of the original panels





patina, so the surfaces were essentially finished," says Railston-Brown. "The in-situ beams had old chalk marks and even some funny notes from the builders. We've actually preserved all of that and just sealed it in, so it's still there for the future tenants to see."

Not only do the exposed soffits tell the story of the building, they also maximise floor-to-ceiling heights and provide an organising system for the exposed services, which in turn avoids the need for raised floors. Track-mounted linear lighting, sprinklers and active chilled beams alternate every three spokes. "It gave us a simple formula to work with," says Gledstone, adding that the chilled beams needed a bespoke "mini" design because of the way the spokes taper towards the core. The exposed design increases future flexibility too, he points out. "We've untangled the building and put it back in a way that you can easily unthread and redo as required.

GROUND-FLOOR PLAN

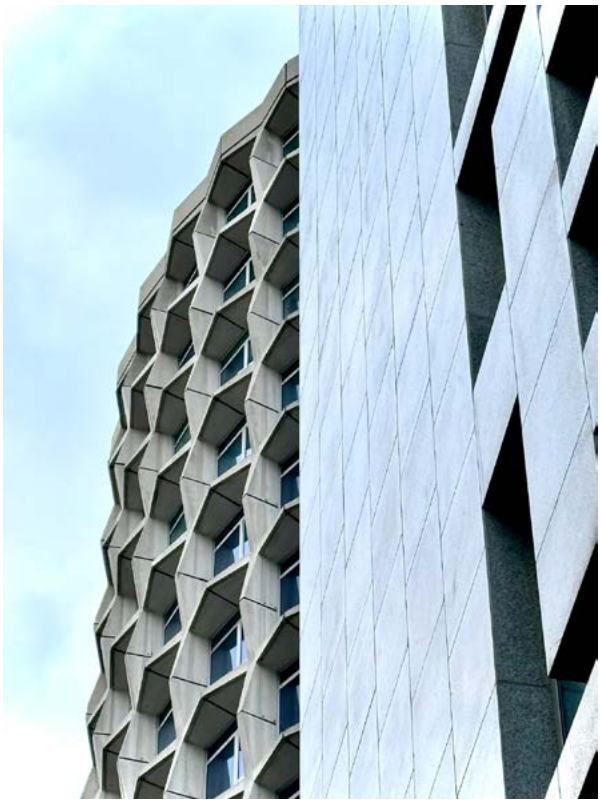
1. Cafe / bar
2. Electrical substation
3. Reception
4. Block reception
5. Retail and restaurants

Maybe the sprinkler system will last 50 years, perhaps the chilled beams can be upgraded in stages. It's an open engine now – we've taken the bonnet off the beautiful car."

The chilled beams are part of an energy-efficient heating and ventilation strategy that also includes air-source and water-source heat pumps. It helps that natural cooling was built into the original building. The sliding windows and open floorplates provide ample opportunities for cross-ventilation – Railston-Brown says that the spaces will benefit from full natural cooling for 30% of the year. In the warmer months, this will work in tandem with the exposed soffits to provide passive cooling. "The building can automatically open the windows by up to about 100mm at night, and that will allow it to breathe, to cool down the structure and thermally load it for the next day."

At the base of the tower, outmoded space has

BELOW
The "bicycle wheel" ceiling provides an organising system for the exposed services. Track-mounted linear lighting, sprinklers and active chilled beams alternate every three spokes



ABOVE
The tower and seven-storey block are linked via a skybridge, as well as new retail and exhibition space below ground level

given way to new uses. Space House was born in a city where the car reigned supreme, with its own petrol station and two levels of parking. These have been converted into the Filling Station restaurant and a cycle centre with 600 spaces and 62 showers, with one of the three parking ramps retained as an entrance for cyclists.

An unusual added advantage of the original tower is that it contains a huge electrical substation at ground and two basement levels, covering almost a third of the floorplate. "It meant there was a huge amount of private realm on the ground floor that was sort of public, but it wasn't quite clear," says Gledstone. "We were able to give fantastic amounts back, and create a double-height event space to establish a connection between the two buildings that had never really existed."

The modular approach of the original construction allowed them to "unzip" the structure by simply saw-cutting the precast planks of the intermediate floor between basement levels one and two, taking away the floors beneath the forecourt where there was less structural load.

The substation also had an extensive ventilation system, which ran all the way up the building and dispersed via the roof. This has been rerouted to exhaust at ground level, with the space on each floorplate reclaimed for two new lifts, increasing capacity by 50%.

A lightwell on the north side of the core – "a bit like staring down the Death Star" – has also been filled in and converted to toilets, meaning that the reconfigured tower meets British Council for Offices standards without any reduction in usable floor area.

Pell Frischmann calculated that the remodelling of Space House has reused 16,500m^3 of concrete, equivalent to approximately 10,000 tonnes of embodied carbon. It also measured the new structure's embodied carbon (lifecycle stages A1-A5) at below 50kgCO_2e/m^2, comfortably under the LETI 2030 target. According to services engineer Atelier Ten, operational carbon will be reduced by 46% in the tower extension and 70% across the rest of the scheme, compared with a notional regulation-compliant building.

The world envisioned in Marsh's watercolour designs, with cars whizzing along the Kingsway, may have faded into distant memory, but it left behind some strong bones. Space House shows how they can be preserved and fleshed out for a very different future. ■

For more on reusing existing concrete elements, go to page 34

PROJECT TEAM

Developer Seaforth
Architect Squire & Partners
Structural engineer Pell Frischmann
Services engineer Atelier Ten
Main contractor BAM Construction
Precast concrete contractor PCE

How Space House crossed a new frontier in the reuse of cladding

It's not quite accurate to describe Space House's two new floors as an extension. Externally at least, one of the extra levels has actually been inserted between the top two rows of precast units.

While the existing loadbearing facade consisted of cruciform modules up to the 15th level, the crown of the building was formed from a ring of T-shaped units, and one of the heritage requirements was that these had to be retained. To introduce the facsimile level, the T-units would have to be removed, new cruciform units installed, and then the T-units reconnected on top.

The process followed a carefully coordinated sequence, designed to limit the time the existing structure, and particularly any of the high aluminium cement (HAC) concrete used in the floorplates, was exposed to the elements.

This started with the demolition of the existing roof slab. The T-units were then removed and holes drilled into the cruciform units below for new connections. The T-units were stored offsite, where they were cleaned and prepared for reinstallation, which involved drilling dowel holes and cutting out the back of the modules to enable connection to a new perimeter ring beam.

Meanwhile, the new cruciform units were installed. These had been designed to exactly match the originals. Even with geometric details from the archive drawings, this involved a lengthy testing process. "We undertook petrographic analysis of samples from the existing units to understand the existing cement content," says Pell Frischmann's Luke Riddoch. Various cement colours and aggregate sizes were trialled before a pale mix with 10mm aggregate was chosen. The surface of the units was also grit-blasted to match the existing texture.

The challenge, Seaforth's Railston-Brown explains, was understanding not only what the original mix contained and how it had aged – but also how any new elements would age. "We were trying to design a concrete mix that wasn't necessarily going to look identical on day one, but would look identical in a year or two, when it had weathered. It was a very long back-and-forth process." This was all the more important because the new elements would be surrounded on both sides by existing units.

The installation of the units was carried out by just four operatives in less than a week. Once they had been tied together and temporarily propped, the new level 16 slab could be cast. This was made from post-tensioned concrete, both to reduce the load on the structure below and to maximise headroom in the new workspace. With the structure now weathertight, the T-units could be brought back to site and slotted into place. The level 17 slab could then be cast, ready for the new setback level and rooftop terrace – a solution to satisfy heritage requirements, maximise reuse of existing elements, reduce waste and provide tenants with panoramic views across London.