Ahead of the curve

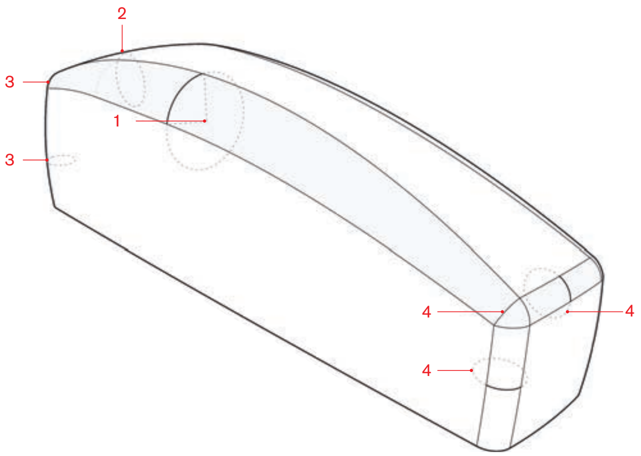
The apparently simple form of Robin Partington and Partners' Park House conceals complex and subtle geometric relationships, writes *Felix Mara*

Call me blasé, but as a born and substantially bred Londoner, I've always found 99 per cent of the architecture of my home town's main shopping thoroughfare in Oxford Street unmemorable. But that percentage has been diminished by the arrival of Robin Partington and Partners' Park House mixed-use development on Europe's busiest shopping street. With a 145m frontage, it dominates surprisingly distant street-level viewpoints. On technical grounds alone, and in particular for its engagement with glass technology, it would warrant at least a paragraph in Pevsner.

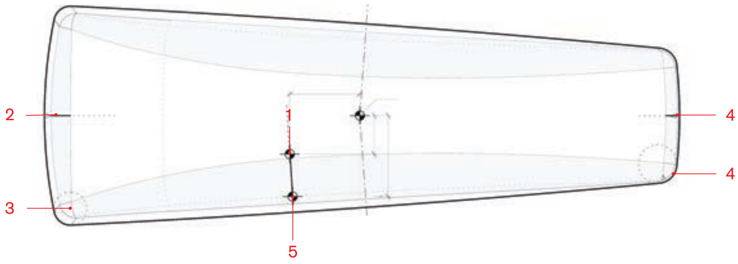
There's a rationale behind Park House's geometry. Its unifying form identifies it as a singular entity on a similar scale to Daniel Burnham's Selfridges across the way. Radiused edges soften its form and, with its crouch-backed roof geometry, Park House bridges the leap in scale between its eastern and western neighbours. Inclined facades optimise the balance between ground-level pedestrian space, and floor area for the offices and flats above the shops, and its tapering plan form accommodates the office entrance at its west end. The outcome may look simple, but it involves complex and subtle geometric relationships, and cladding components needed to be rationalised to keep a handle on the cost and programme. Parametric software, initially used by Robin Partington and Partners to convince the project team that Park House was a viable >>

Left View from Reed Place looking north
Below Aerial view looking south-west across Hyde Park

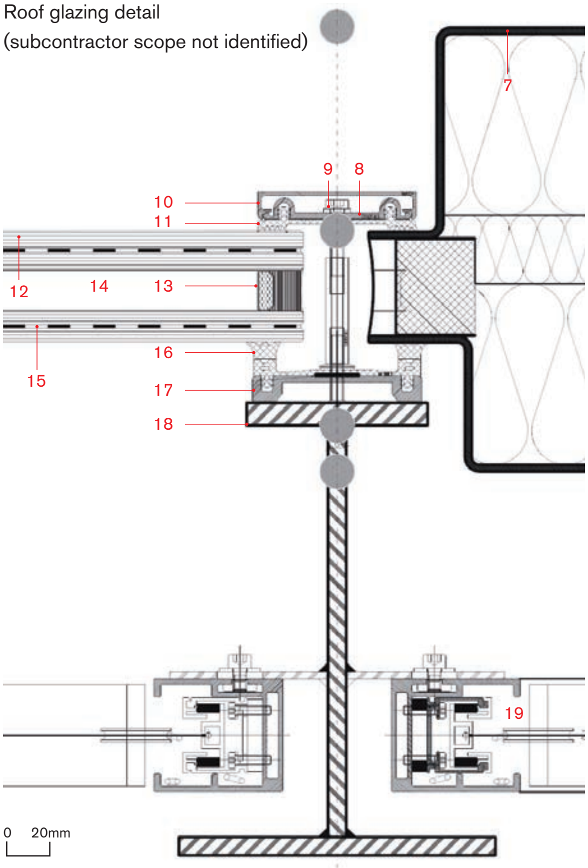
Volume set-out 3D design drawing



Volume set-out design drawing from above



Roof glazing detail
(subcontractor scope not identified)

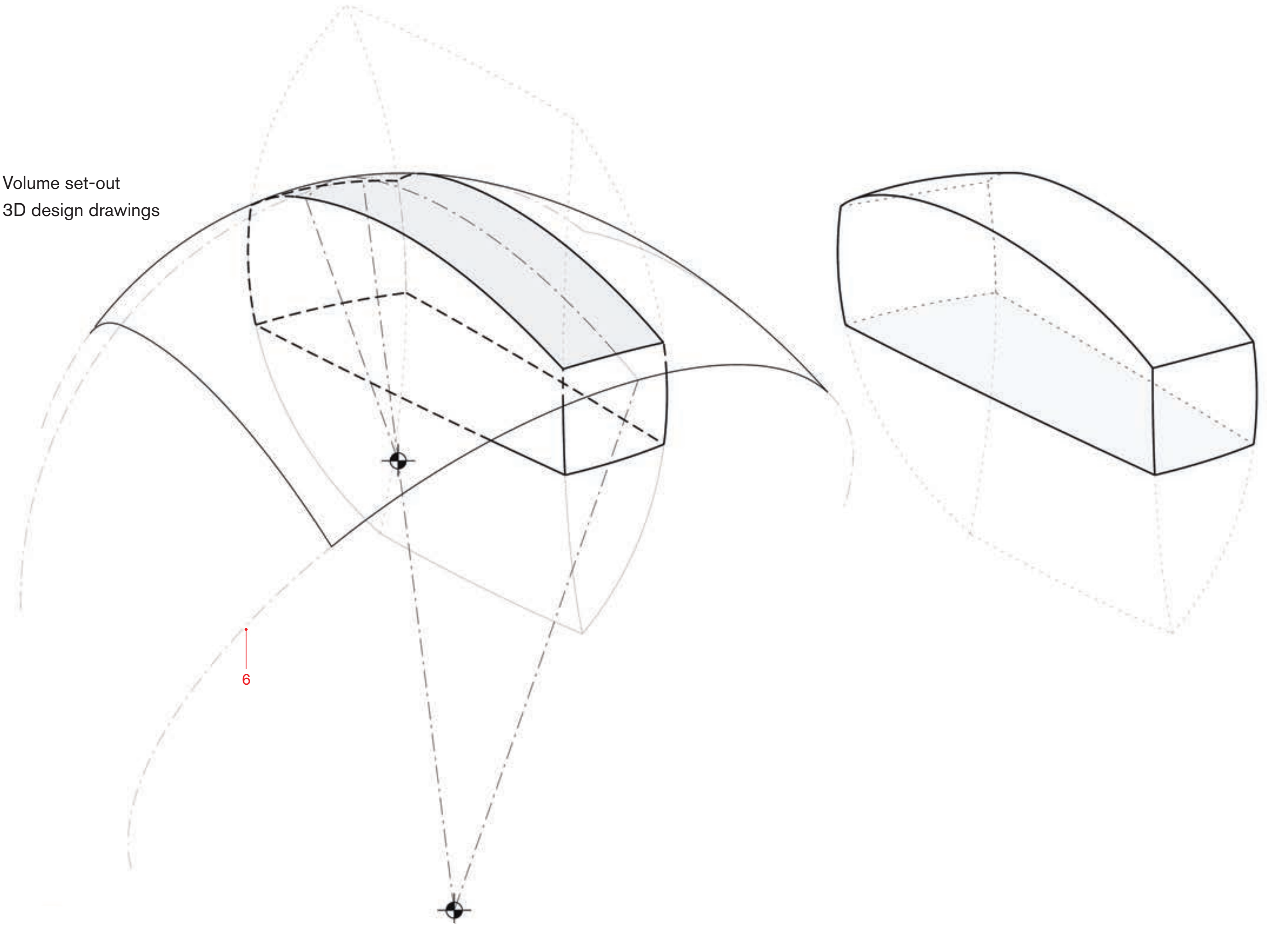


COURTESY OF SEELE WITH ADDITIONAL ANNOTATION BY RPA AND AJ

construction proposition, was invaluable and it picked up Bentley's Be Inspired Generative Design award in 2012.

First, Robin Partington and Partners used Bentley Generative Components parametric software and Bentley Architecture to refine the setting out of the external envelope, producing a network of dynamically linked geometrical relationships. The top surface of the roof and each of the four facades were defined as tori which intersect to generate the overall volume. These tori have radii as large as 2.5km, and the radius and locus of each torus was adjusted to fine-tune the building's geometry according to its rationale. The four facade tori all have the same radius, optimising panel repetition economies. The junctions where the toroid surfaces of the facades meet were defined as a >>

Volume set-out
3D design drawings



Level 2 floor plan

Opposite View from north-west with entrance to offices on right

1. Centre point of 10.5m arc
2. Radius 6.75m
3. Radius 3.45m
4. Radius 4m
5. 10.5m arc intersects with unfilleted edge of cladding envelope
6. Radius 100m
7. Insulated pressed aluminium sandwich panel
8. Clamping plate
9. Hex head M6 x 30 screws at max 230mm centres, with M6 washers, theaded M6 x 47 sleeves. 6mm dia A2 Fabco washers, M6 x 30 welded stud bolts
10. RAL 7024 aluminium capping extrusion
11. Black silicone single-piece gasket
12. Laminated glass with 1.52mm acoustic interlayer
13. Black spacer
14. 18mm cavity
15. 6+6mm laminated annealed glass with 1.52mm acoustic interlayer
16. Black EPDM single-piece gasket
17. RAL 9010 aluminium profile
18. RAL 9010 laser-cut fabricated steel mullion
19. Integrated blind track
21. Office
22. Apartments

The facade engineer's view

Unique steel mullion beams span the two floors. These have vertical webs, with perpendicular curved bottom flanges. The top flange is faceted with each facet kept parallel to the glass geometry.

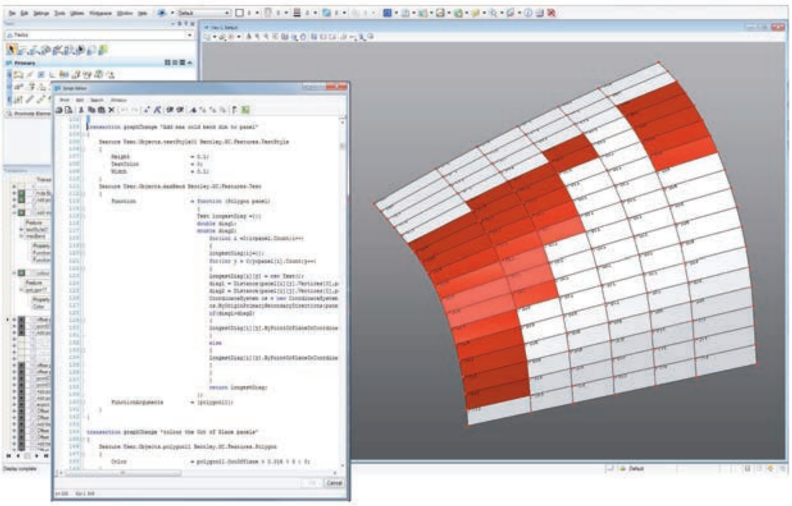
Unique aluminium transoms have connection geometry which requires unique five-axis machining at each end. The steel and aluminium elements create the cladding grid, with each opening unique and twisted, but with straight edges.

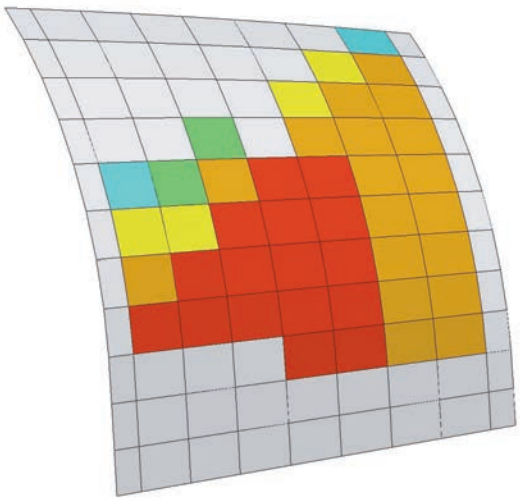
Factory-installed single-piece gaskets on each mullion and transom have the necessary fixings and supports for the metal panels and glazing. Each opening is a unique hyperbolic paraboloid. The metal panels were manufactured from two aluminium skins, each made to the correct distorted shape.

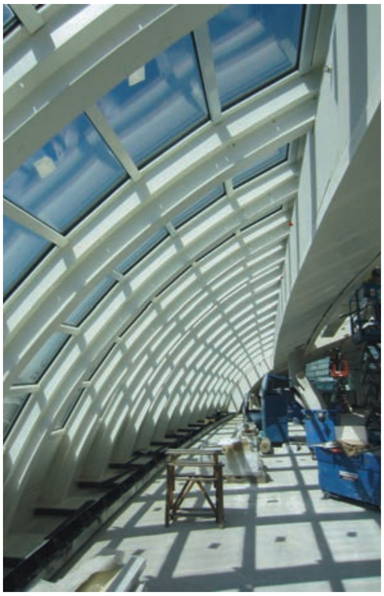
Approximately 80 per cent of the double glazing was optimised to allow cold bending to a maximum of 60mm. Where the distortion was too great, hot-bent glass was manufactured in a specialist process which did not require moulds.

Will Stevens, director, Interface Facade Engineering (formerly director, Ramboll Facade Engineering)

Right The detailed facade model enabled offset points for facade components to be appraised
Below Facade models identifying panel types enabled options and warping to be appraised
Opposite Roof glazing framework with single-piece gaskets in place prior to installation of clamped glass panel







Above The tapering beams were part of the glass roof contractor's package, enabling them to be fabricated and installed to tight tolerances
Right The roof glazing comprised inner and outer warp-planes of laminated glass

It was possible to cold bend many of the glass panels on site

series of cones which are tangentially related to the gently curved surfaces of the principal facade plane, and also rationalised panelisation. 'The main area of complexity was the fillet zone between the facades and the roof,' says Robin Partington and Partners' project director Paul Rogers. Here, the facade tori have to blend with the roof torus, and software which enabled these local relationships to be quickly appraised and refined was essential.

The next stage involved defining the size and geometry of the glass and aluminium panels used to construct the facade and roof. The vast majority of these panels, including those on the roof, were double-glazed units. There are, of course, cost premiums attached to bent – and in particular double-curved – glass panels, driven by a hit-and-miss manufacturing process which involves remaking units whose geometry is outside the required tolerances. However, it was possible to cold bend approximately 80 per cent of the panels on site rather than heat bending them in the factory, and this was beneficial to the cost and to the programme.

Robin Partington and Partners also used Bentley software to maximise the number of panels which could be cold bent and to optimise their size. This modelling process resembled a complex equation which enabled the architect to evaluate the essential variables: reducing the size of panels (and therefore their bow) to achieve a closer approximation to the curved setting out entailed more junctions, which carries a cost penalty; pronounced faceting is potentially visible and offsets between adjacent panels, especially at corner intersections, not only create visual 'ping', but are more difficult to construct and make weather-tight.

This parametric modelling was just the beginning of an elaborate reiterative process of appraising and developing the surface geometry of the cladding and secondary support structures, as well as the interface between the two, which involved cladding specialists Seele and Focchi. But it was an essential stage in the project, without which Park House would have been more angular, less transparent, or even both. ■

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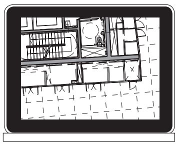

Project data

START ON SITE May 2010
COMPLETION November 2012
FLOOR AREA Retail space (basement, ground and first floor levels): 8,140m²
Office space (grade A): 15,140m²
Residential (39 private flats): 5,430m²
PROCUREMENT Fixed price design and build
CONSTRUCTION COST £131.9 million (excluding external works and demolition)
CONSTRUCTION COST PER SQUARE METRE £2,955 (across all elements of building, including high-specification residential finishes)
CLIENT QNB Capital
ARCHITECT Robin Partington and Partners
STRUCTURAL ENGINEER AKT II
M&E CONSULTANT Long and Partners
QUANTITY SURVEYOR Gardiner & Theobold
ACOUSTIC CONSULTANT Hann Tucker Associates
ACCESS CONSULTANT David Bonnett Associates
PUBLIC ART CONSULTANT Davidson Art Partnership
FACADE CONSULTANT Ramboll Facade Engineering
ACCESS AND MAINTENANCE CONSULTANT Reef Associates
FIRE CONSULTANT Ramboll Fire & Safety
SPECIALIST LIGHTING DESIGNER GIA Equation
ARTISTS Carpenter Lowings and Walter Bailey
PROJECT MANAGER GTMS
CDM CO-ORDINATOR Mace Sustain
APPROVED BUILDING INSPECTOR Westminster City Council
MAIN CONTRACTOR Mace
CAD SOFTWARE Bentley Architecture, Bentley Generative Components, Bentley MicroStation, Bentley Structure (used by AKT II)
ANNUAL CO_2 EMISSIONS Not confirmed