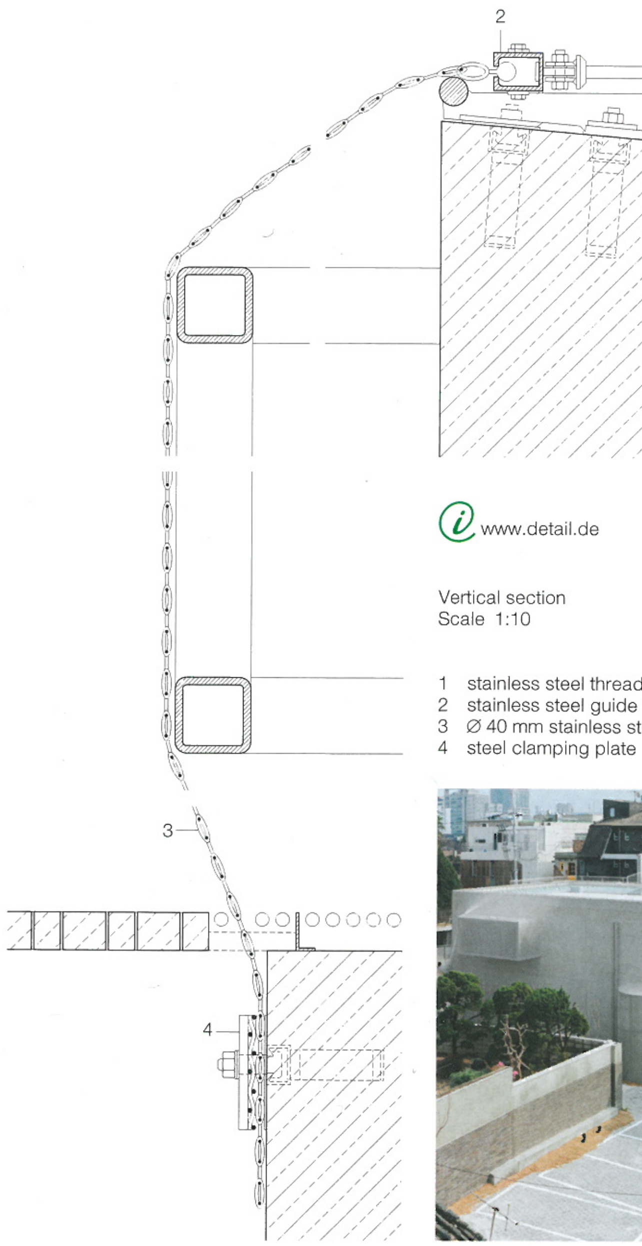
SO–IL's Kukje Gallery in Seoul: Permeable building skin of steel rings

Roland Pawlitschko

Architects:
Solid Objectives – Idenburg Liu (SO–IL), New York
Jong-Ga Architects, Seoul
Mesh System Design Consultant:
Front Inc., New York

Since its establishment 30 years ago, Kukje Gallery has become one of Seoul's most important art venues. In April 2012, its third gallery building opened in Sogyeok-dong – a neighbourhood north of the central business district characterized by small-scale homes, cafes and boutiques. In accordance with the master plan of the art campus, the new six-metre-high cube is situated next to the two older galleries. Its concrete shell encloses an art space, illuminated via the roof, for exhibitions, performances and events. To retain the pure geometry of this White Cube inside the gallery, portions of the building were attached to the four outer walls: a vestibule, a lift, a building-services enclosure, and two staircases. Curved stairs connect the art space to the two lower floors, where the lecture hall and administrative, retail and storage spaces are located. An exterior steel staircase leads to the exposed roof terrace. To counteract the appearance of rigidity in the resulting building form, the architects developed a second skin that was to envelop the structure like fog. They built a number of models experimenting with elastic fabrics, arriving at a custom-tailored, chain-mail skin of stainless steel rings that covers the building smoothly from roofline to ground without wrinkles. The result is a building at once orthogonal and amorphous, whose hazy exterior lets it retreat into the heterogeneous surroundings.
The 510,000 interlocking rings were first cut from 3.5-millimetre-thick wire coils and then manually linked, welded shut and smoothed. There were two main challenges: first, to develop a computer model to define the precise position of each ring (a task taken on by architects and consultants Front Inc.); and second, to prevent the mesh from sagging. Following a number of tests, 15 separate segments – fabricated by craftsmen in China and delivered to Seoul – were installed with great precision, making their seams invisible. Rigid points of connection located in the ground and above the glazing, as well as spring-loaded connections at the roof parapet, ensure that the fit of the chain mail remains taut.



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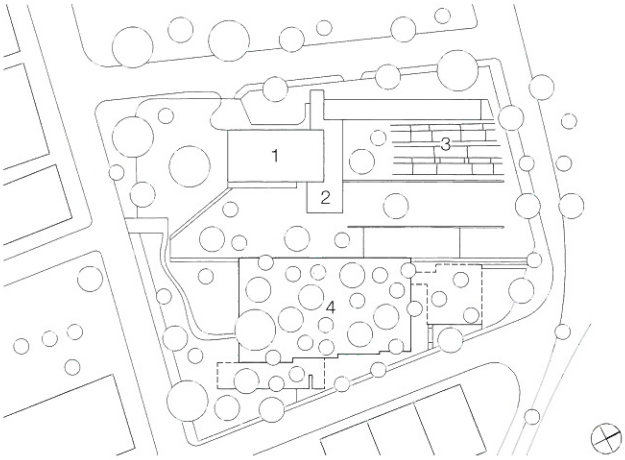
Vertical section
Scale 1:10

1 stainless steel threaded rod
2 stainless steel guide rail
3 Ø 40 mm stainless steel ring
4 steel clamping plate

Restaurant Extension in Olot

Architects:
RCR Arquitectes, Olot
R. Aranda, C. Pigem, R. Vilalta
Team:
M. Subiràs, M. Venâncio, A. Lippmann,
V. Vitoriano, M. Ortega, M. Rodríguez,
A. Moura, D. Breathnach, D. Aubert,
F. Fluvià, J. Choi
Structural engineers:
Blázquez-Guanter arquitectes, Girona
Others involved in the project: see page 217

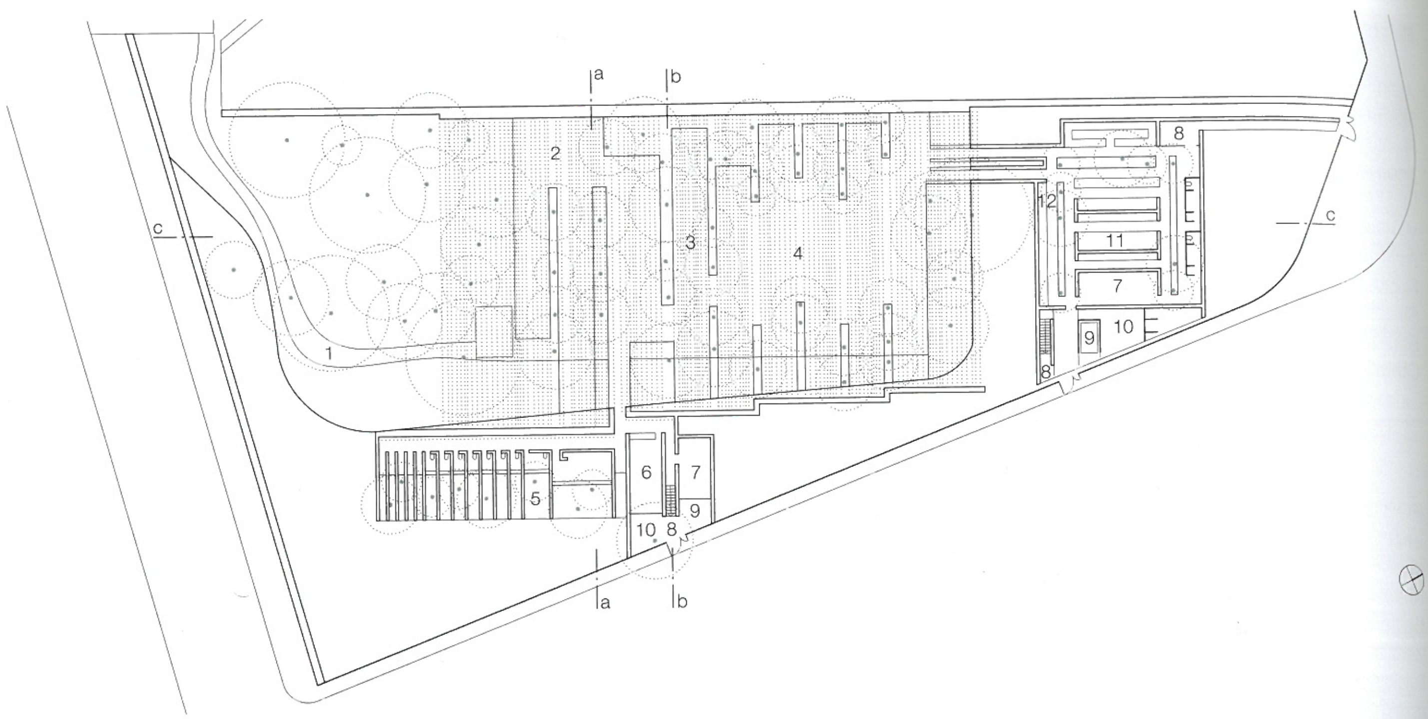


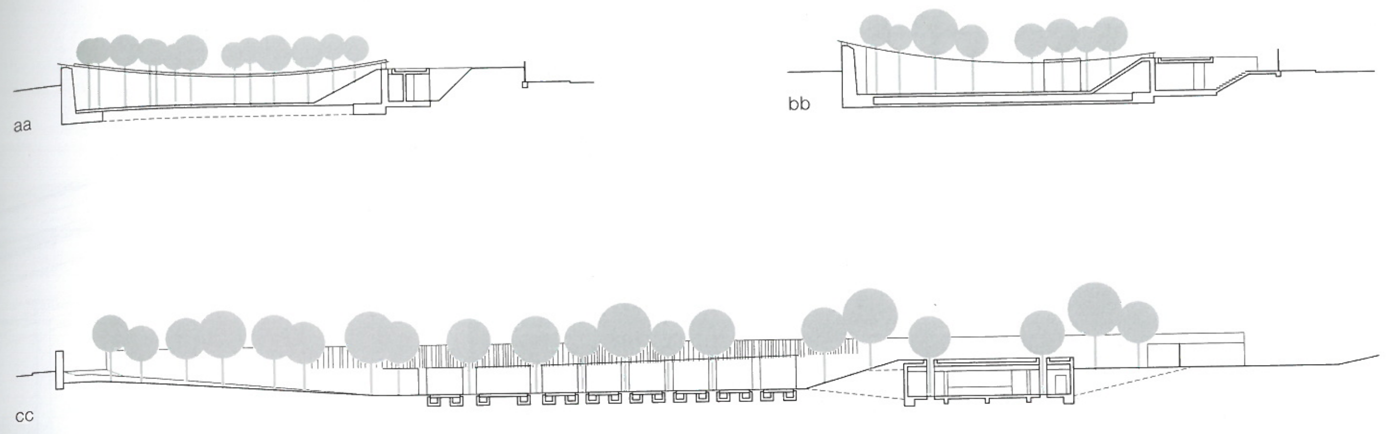
Site plan
scale 1:3000

1 Former farmstead
2 Restaurant (2002)
3 Pavilions (2005)
4 "Tent" (2011)

RCR is based in Olot, a small city in northeast Catalonia. It is here that, years ago, their working relationship with Les Cols – a restaurant renowned throughout the region – began. In the first phase, an old farmstead was converted into a modern dining establishment; later pavilions – that are at once minimal and sensual – offering overnight accommodations were added (see DETAIL German Edition 6/2006). The notion of a bucolic picnic served as inspiration for this most recent extension: irregularly spaced steel tubing spans a hollow on the east of the site and is the ordering device for the new "tent". The translucent roof membranes and transparent partitions serve more as protection from the elements than as spatial definition. As guests approach the hollow and get a glimpse through the entire length of the restaurant, they spot the slope on the other end. Perpendicular to that vista, running parallel to the structural tubing, the suspended PVC-membrane partitions zone the space and define the narrow atria that extend into the dining space and are inhabited by trees. In the years to come, the picnics will take place beneath the trees' canopy. Even the bespoke acrylic-glass furniture conforms to the architects' quest for dematerialised space. In contrast, the earthbound "vessel" – the floor and walls – is characterised by basalt collected nearby. Cobblestones in a mortar bed serve as paving and cloak the steep west berm, while larger formats are strewn in the atria and upon the east slope.

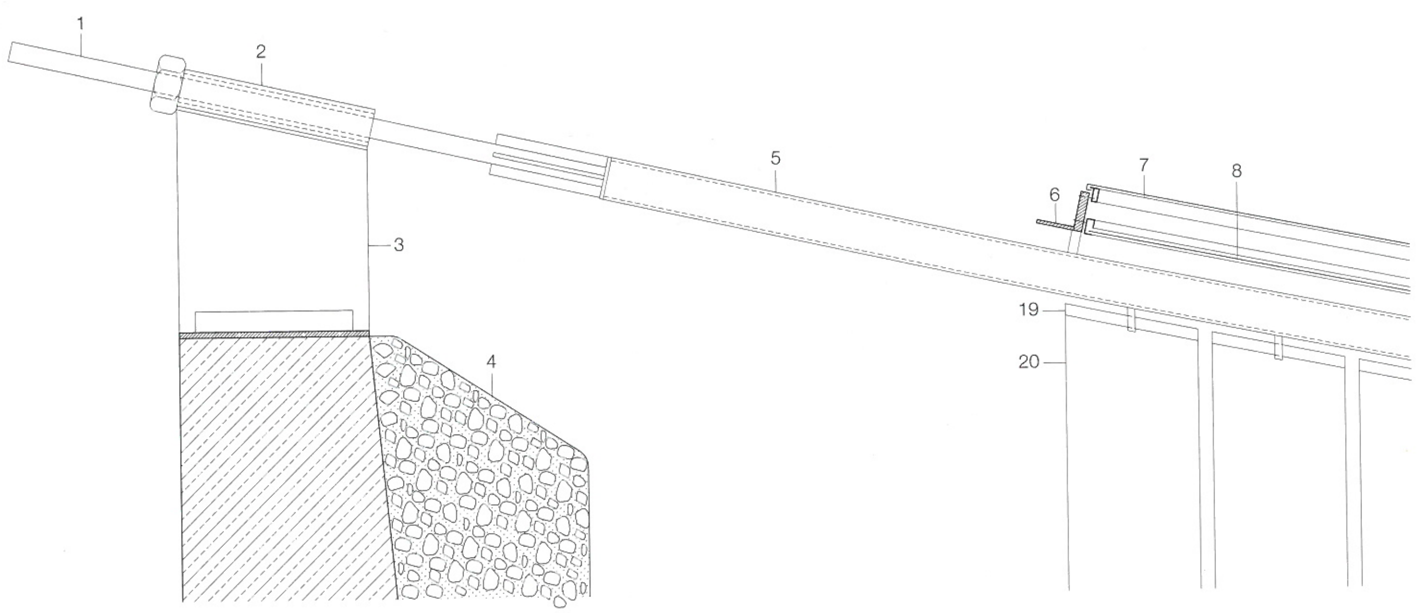
All components of the technical and service infrastructure are either concealed or are positioned unobtrusively. Linear LED lamps with cone reflectors positioned on top of the steel cables make the "tent" glow at night. The sound system and building services ducts are tucked away underground. Also concealed beneath the sculpted terrain are the kitchen and restrooms: the narrow glazed atria and a gentle upward slope provide these spaces with a link to the world beyond.

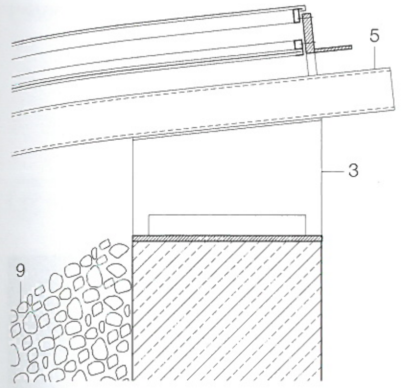


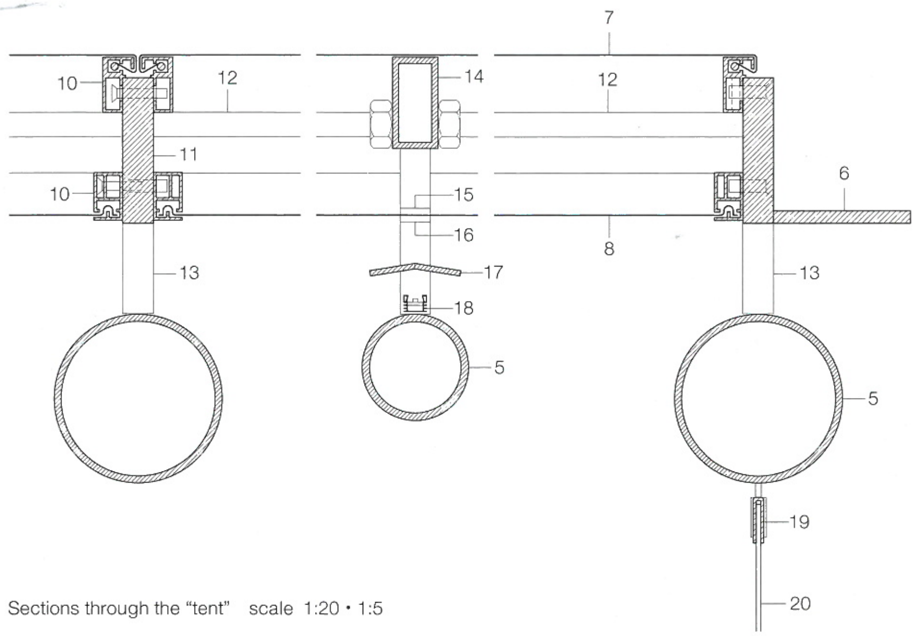


Layout plan • Sections
scale 1:750

1 Access ramp
2 Pre-dinner drink
3 Dance floor
4 Dining hall
5 Washrooms
6 Cloakroom
7 Storage
8 Side entrance
9 Freight elevator
10 Delivery
11 Kitchen
12 Employee cafeteria

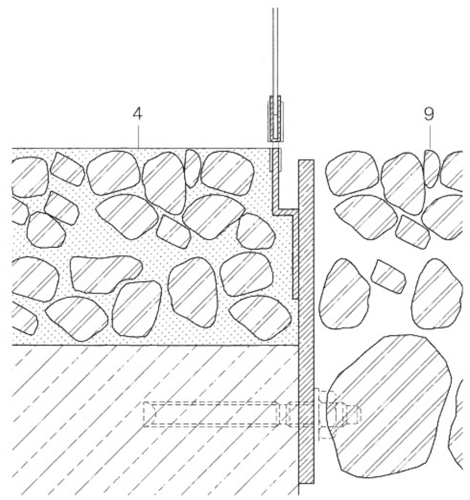


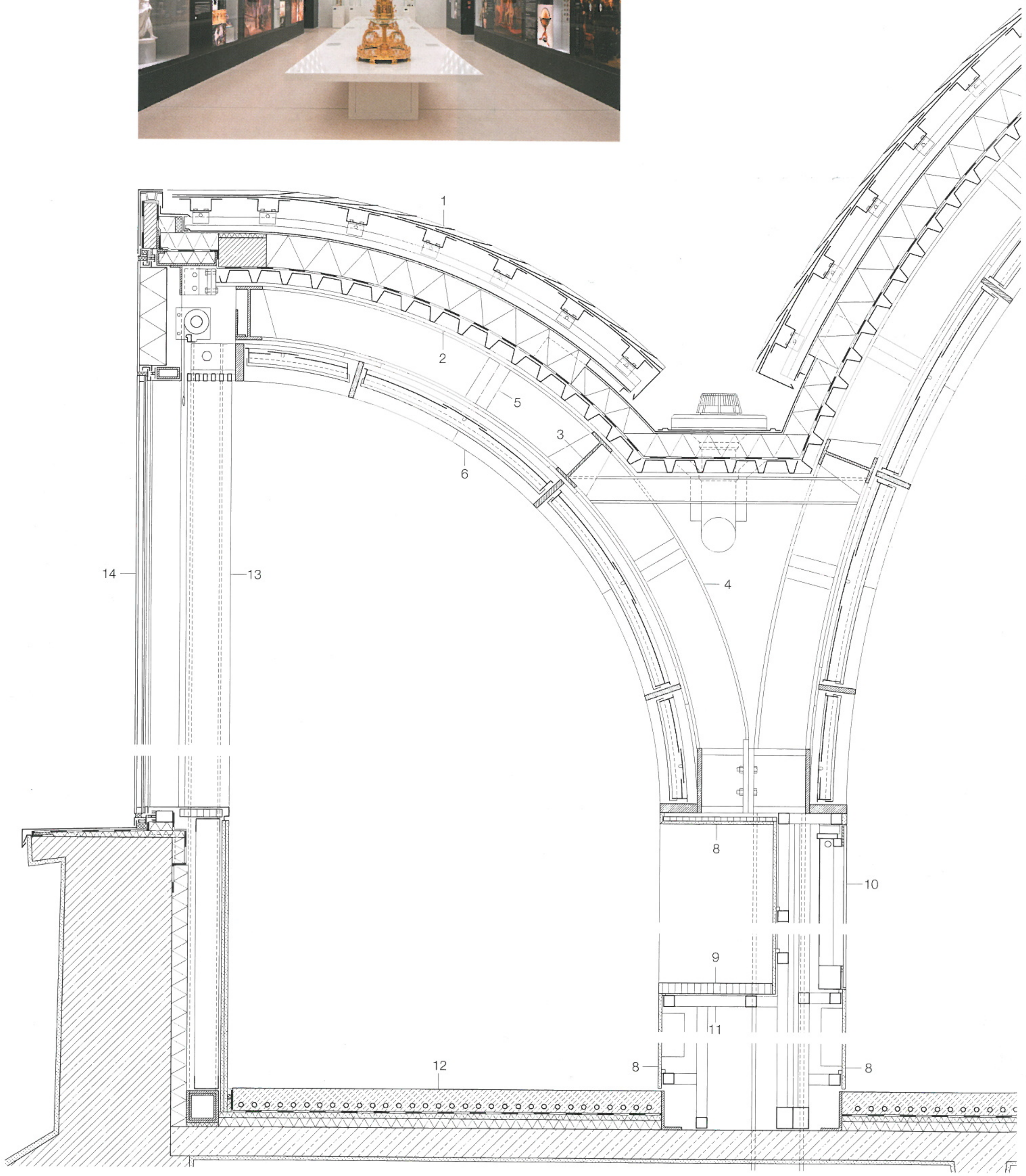


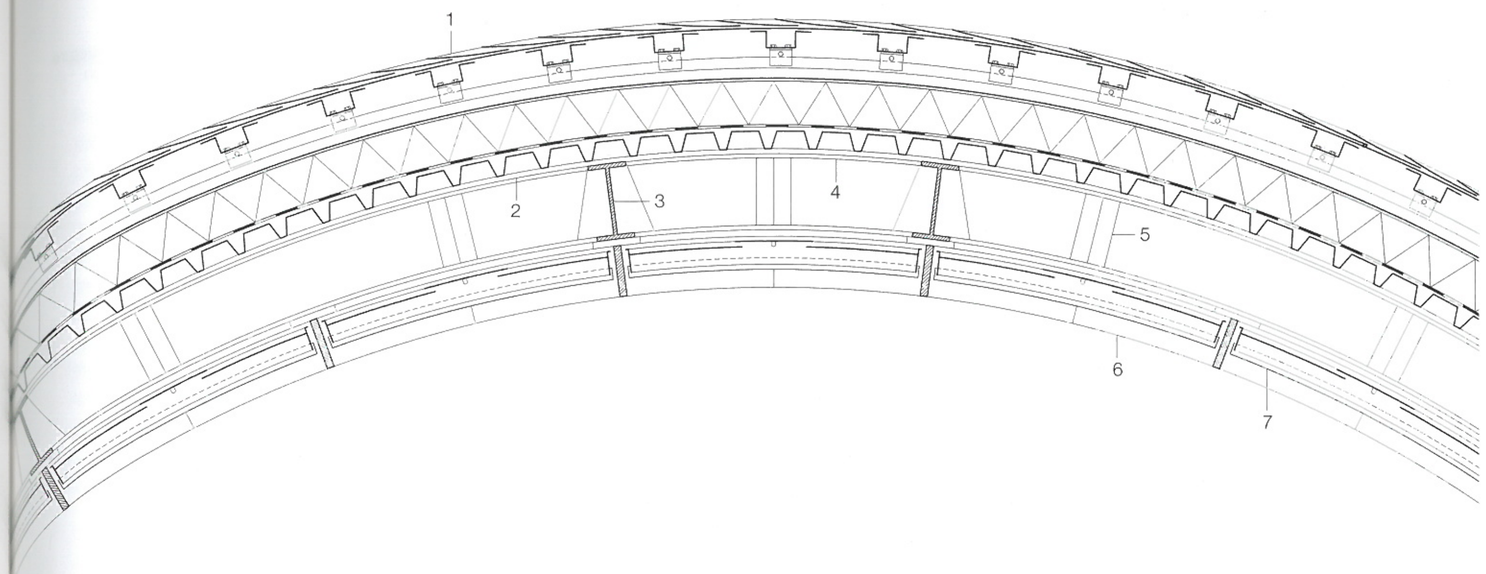


Sections through the "tent" scale 1:20 • 1:5

1 threaded rod to adjust structural steel tube
2 suspension of steel tube: steel-tube sleeve
3 steel-plate bearing surface welded to structural tubing
4 basalt cobblestones in mortar bed
5 Ø 70 or 90 or 111 mm steel CHS (load-bearing), 26–30 m long (shorter segments welded together)
6 roof edge profile: steel angle 100/20 mm and 90/8 mm steel flats
7 0.25 mm upper ETFE roof membrane, imprinted with Ø 4.2 mm dot matrix, colour: aluminium
8 0.25 mm lower ETFE roof membrane, transparent
9 basalt filling
10 ETFE membrane anchor: edge profile, all sides extruded aluminium
11 96/20 mm steel flat
12 distancer/ Ø 16 mm steel rod, partially threaded (180 cm centre-to-centre)
13 Ø 20 mm steel distancer
14 60/30/3 mm steel RHS
15 2.5 mm washer
16 2 mm silicone washer
17 cone reflector
18 LED linear white, in extruded aluminium profile
19 1.5 mm stainless-steel profile, rotatable connection at centre
20 3 mm PVC membrane, transparent





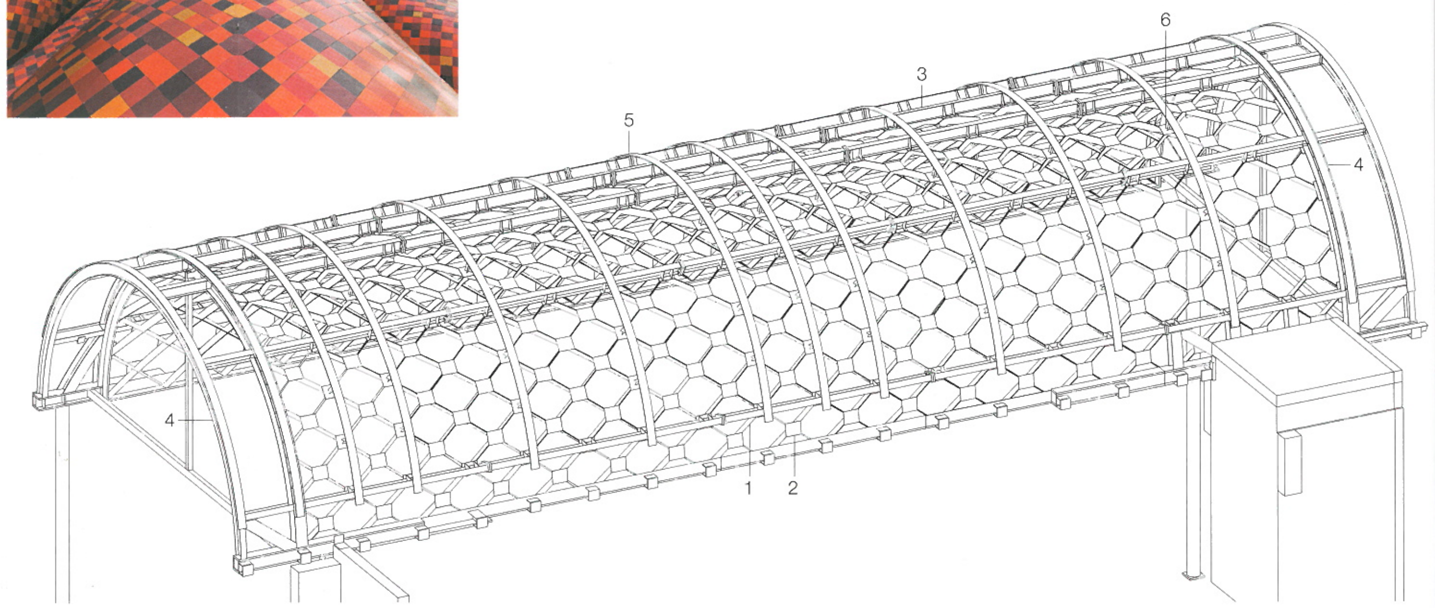


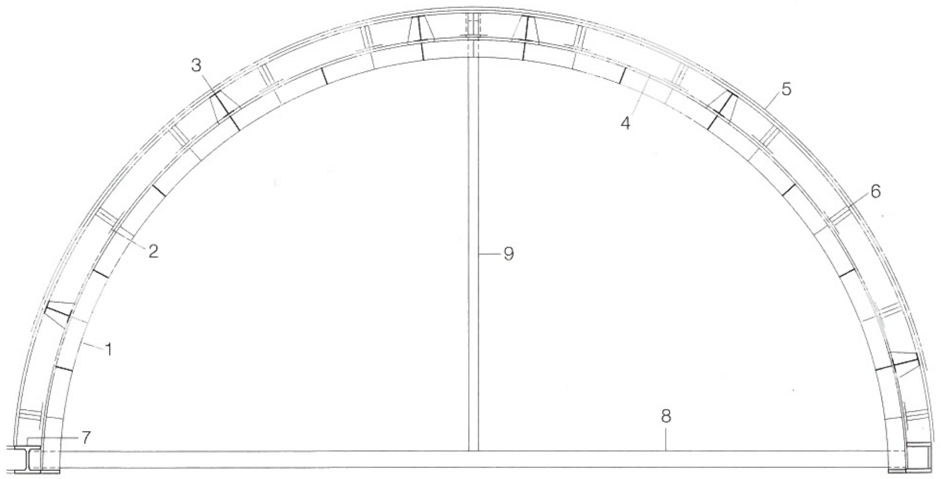
Vertical section
scale 1:20

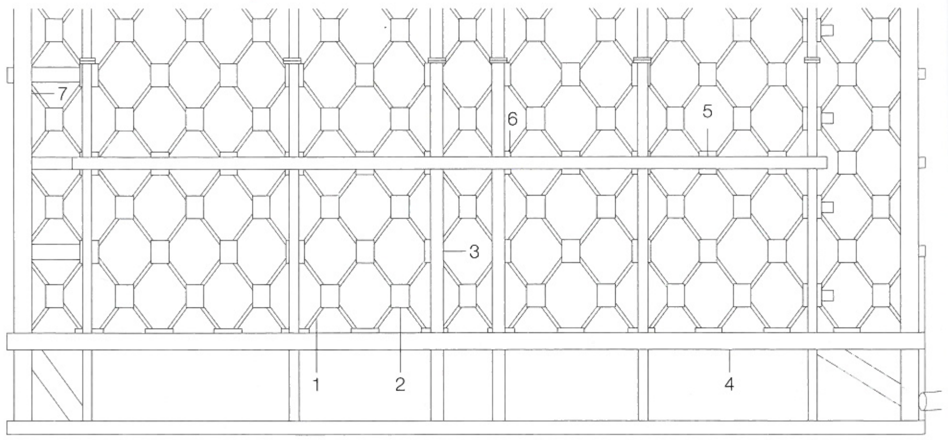
1 aluminium tiles anodized in red tones with concealed riveting sheet-aluminium panels with 4 mm polythene core
3 mm aluminium lipped channels cleats; 2 mm aluminium standing-seam roof
140 mm mineral-wool thermal insulation
vapour barrier
40 mm trapezoidal-section metal sheeting
2 120/16 mm steel-flat bearer
3 200 mm steel I-section purlins fixed longitudinally
4 200 mm steel I-sections fixed laterally (only at edge of vaulting)
5 10 mm sheet-metal gussets as distance pieces
6 140/15 mm flat-steel bearers forming grid according to Zollinger principle
7 lighting recess:
1.5 mm satin-finished PETG
LED fitting
1 mm sheet aluminium
8 12 mm acrylic-based mineral material
9 40 mm medium-density-fibreboard seat veneered with smoked oak
10 11 mm laminated safety glass showcase, rear-lighted
11 40/40 mm aluminium SHS tube
12 85 mm polished screed with heating/cooling runs
separating layer
20 mm impact-sound insulation
35 mm levelling layer
existing reinforced concrete
13 100/50 mm steel RHS facade column with 2 mm polished stainless-steel cladding
14 2× 4 mm laminated safety glass + 16 mm cavity + 6 mm toughened safety glass (U_g = 1.1 W/m²K)

1 140/15 mm steel-flat bearers former grid according to Zollinger principle
2 5 mm metal mounting plate for fixing soffit
3 200 mm steel I-section purlins, fixed longitudinally
4 200 mm steel I-sections fixed laterally (only at edge of vaulting)
5 120/16 mm steel-flat bearers for trapezoidal-section sheeting
6 10 mm sheet-metal gussets as distance pieces
7 200 mm steel I-section edge beam
8 140/80 mm steel RHS (only at edge of vaulting)
9 Ø 80 mm steel SHS tube

Isometric of steel structure
Diagrammatic section
Top view







King's Cross Station in London

Architects:
John McAslan + Partners, London
John McAslan, Hiro Aso
Simon Goode, Pauline Nee
Team:
Mark Bell, Allan Dor, Louise Hanson, David Jackson, Dean Kirkwood, Michael Mason, Aidan Potter, Sascha Stscherbina, Philip Veall, Jasmine Wadia, Katherine Watts
Structural engineers:
Arup, London
Others involved in the project: see page 677

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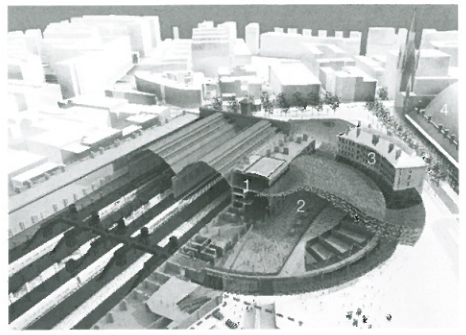
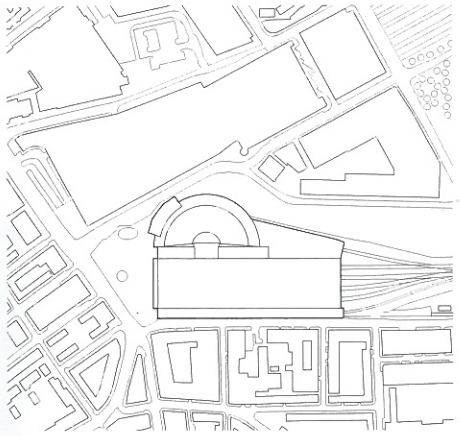
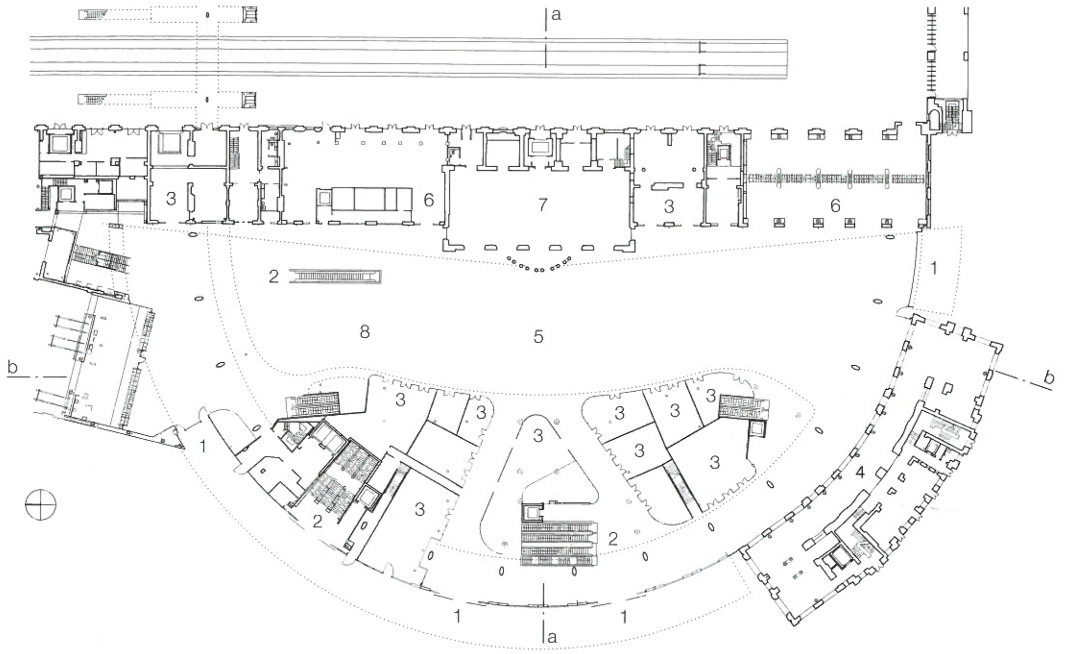


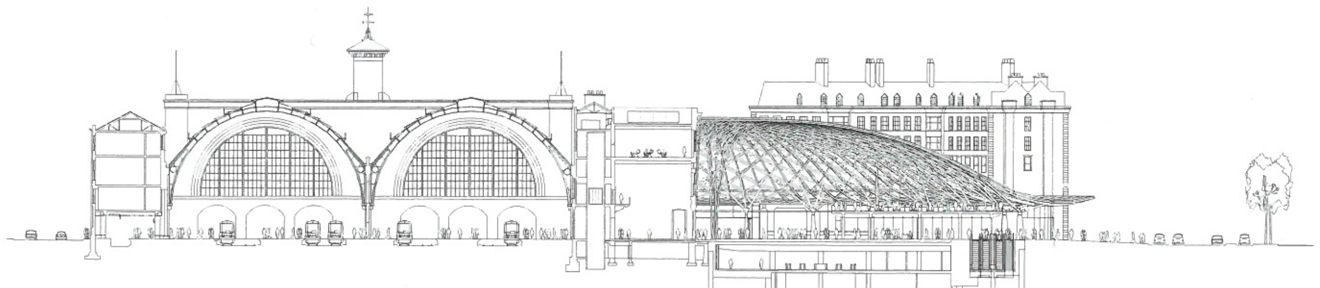
1 Western Range building
2 Western Concourse
3 Great Northern Hotel
4 St Pancras International



Site plan scale 1:10000

Since its completion in 1852, London's King's Cross Station has been one of the capital's most important railway termini. Created by Lewis Cubitt in Victorian style and now functioning in conjunction with an underground station for six lines, as well as the neighbouring St Pancras main-line station, King's Cross forms a much frequented node in the public transport system of the city.
In view of the fact that Cubitt's original structure had long been unable to cope properly with the growing number of passengers, the building client, Network Rail, decided to modernize the station. As early as 1998, the architects had drawn up an urban master plan in conjunction with Ove Arup. This foresaw moving the new station hall to the west and in the first instance creating a design with departing passengers in mind.
The new Western Concourse is impressive for its filigree, white load-bearing lattice structure. A volume has been inserted in which shops and restaurants have leased a presence. The ticket offices are situated opposite in the west wing. Here, the old listed building has been carefully restored to its original form. In front of its brick facade, a white steel lattice structure grows from the ground, branching out as it rises to form the curved roof. The whole is covered with aluminium panels and areas of glazing at the edges, through which light can enter and one catches glimpses of the Cubitt facade.





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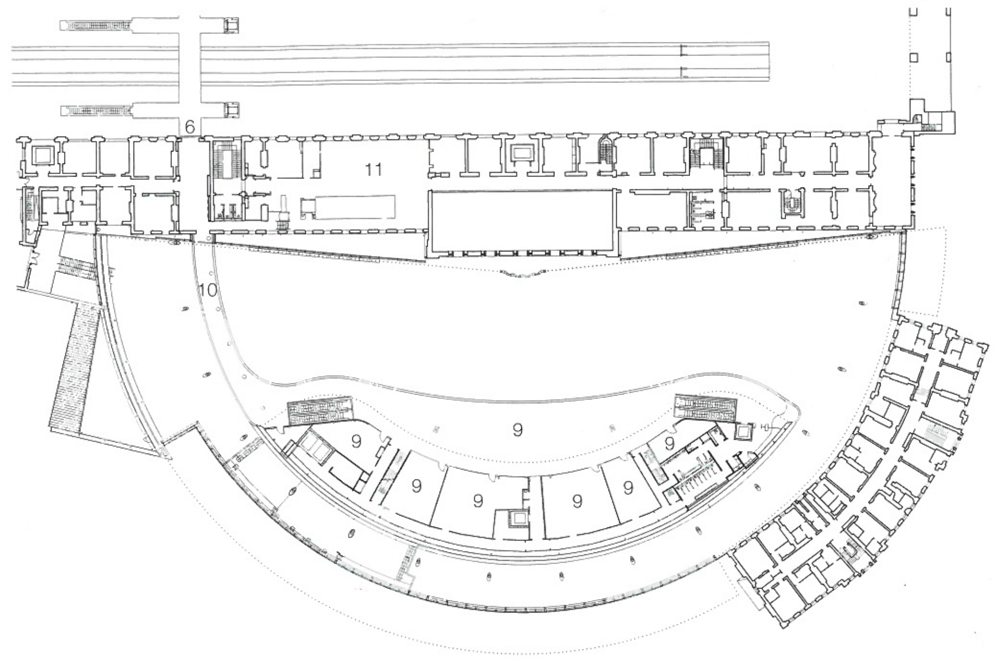
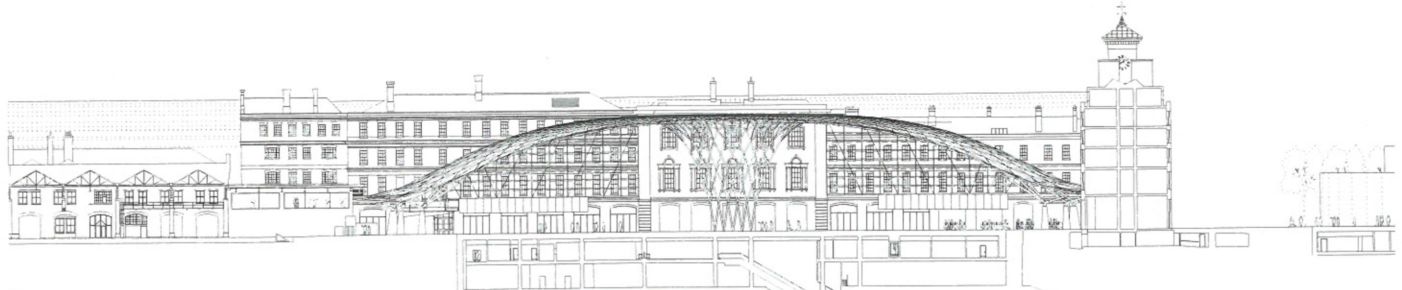


The complex constructional situation called for a close collaboration with the structural engineers from the very beginning of the design. So many built volumes exist below ground – like the northern ticket hall of the London Tube station – that space for new foundations was restricted to only a few locations. Nor was it possible to transmit loads to the adjoining Western Range structure. The solution for the erection of a roof over the 7,500 m² area of the Western Concourse was found in the creation of a free-standing, rigid half-dome: a steel structure with a radius of 60 m, consisting of radial box girders and diagonal tubes.
Since the semicircular lattice shell describes an S-shaped curve in section, shear forces are conducted away from the facade of the existing building. They are all the greater, however, in the area of the curved edge of the roof structure, where it is borne by 16 piers that reach upwards in tree-like fashion, each with four branches supporting the lattice-grid at node points. The piers bear loads of up to 600 tonnes, which are transmitted to the ground via newly bored piles and the enclosing walls of the Tube structure beneath the station.
Standing centrally in front of the existing building is a funnel-like column into which the lattice-shell roof flows. Every other radial box girder terminates at the upper end of the funnel. Here, the outer aluminium covering gives on to a semicircular glazed roof. The remaining girders come to an end as the funnel becomes increasingly slender downwards. An arched edge beam forms a relatively rigid conclusion to the lattice shell next to the existing structure. Suspended from this beam is a glass-louvre facade, which serves the needs of natural lighting and ventilation in the hall.
In view of the relatively light weight of the steel roof structure, it was possible to install large prefabricated sections of the lattice shell by crane. This considerably reduced the amount of on-site welding as well as the assembly time, which in turn simplified the construction logistics and helped to avoid any interruptions to train services.

Plans • Sections scale 1:1250

1 Entrance
2 Underground entrance
3 Shops
4 Hotel
5 New concourse
6 Access to platforms
7 Tickets
8 Information
9 Restaurants
10 Pedestrian bridge
11 First-class lounge



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