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Great Britain | London | The Great Court at The British Museum

Project:
The Great Court at
The British Museum
Location:
London, Great Britain
Product:
OKATHERM
Square metres:
6700 m²
Architect:
Foster and Partners, London
Execution:
Waagner Biro, Wien
Completion:
2000

A square courtyard from the middle of the 19th century. Intended as a courtyard by its architect, Robert Smirke, basically misappropriated only five years later by his brother with an enormous dome construction, and about one hundred and fifty years later made into one of the largest and most magnificent covered courtyards in Europe by means of a brilliant construction: the Great Court at The British Museum. Think the impossible. Creating visions and letting them materialise, three-dimensional structures of almost incomprehensible complexity, that requires farsightedness. Concentrated knowledge, as collected in the British Library and its historical Reading Room, is not sufficient here. Only the ideal partnership of planning visionaries and daring engineers with forward-thinking and further-thinking high-tech designers creates fascinating reality from the incomprehensibleThe glass roof construction of the Great Court at The British Museum, London/UK. With a total surface area of 6700 square metres, the self-supporting glass dome extends over the Great Court. The space thus created accommodates not only a restaurant but also galleries and shops, and is the actual centre of the museum complex. The flat-vaulted roof ring is limited at right angles and, with its dimensions of approx. 95 x 75 metres, spans the area of a football pitch. The roof shell is pierced by the eccentric dome of the Reading Room; it consists of exactly 4,878 different rods, 1,566 different node points and 3,312 differently sized

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triangular insulating glass panes. With 315 t of glass and 478 t of steel, the total weight of the construction is almost 800 tonnes. Basically, the dome is similar to the Pantheon in Rome, where the upper dome ring is lowered and rests on the wall cylinder of the round structure. The lower connecting ring is designed as a rectangle, which has the significant disadvantage for the structure that there is no circular frictional connection and the pressure on the abutment has to be dissipated. The deflection-resistant edge arches, the braced corners and the construction of a rigid roof shell contribute to this dissipation. In the design of the roof geometry and in the structural calculations, special conditions for the supports as well as height restrictions had to be taken into account. The Reading Room itself could not be used for the removal of the roof loads; as one of the oldest iron constructions in the country, it is too delicate. Things are put right by the twenty steel supports, cast in concrete, which surround the cylinder and bear the load of the ring-type anchor. Hollow profile rods were used on account of the calculations for moments of force, deformations and in particular for the buckling factors. In the subsequent design phase, the rods were optimised to a standard dimension of 80 mm, which corresponds to the width of the glass connecting piece. All calculations were carried out on the basis of second-order theories, all imperfections were taken into account; these were applied with the deflection of the first intrinsic

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buckling form with the maximum value of 140 mm length of span. After the exact geometry and the structure of the roof had been analysed, a node had to be developed - and that was certainly the greatest challenge - to absorb the force flow and the moments of flexion and to make a connection between the large number of different rods possible at all. The first models were based on round nodes and prisms with triangular frames for the glass pane; however, they were too expensive, and moreover were not acceptable in architectural terms. A total of seven options with countless variants were developed, before the eighth version provided the solution: from a plate of sheet steel, five and six-armed star-shaped nodes were cut out vertically with the help of a laser beam. Parallel to this, a method was sought to automate the production, preliminary construction and final assembly. On the basis of the node forms alone, standard methods as well as manual processes had to be ruled out. This applied to the production as well as to the construction, everything had to be positioned by machines, highly accurately and automatically. Due to the complex structural factors, a partial assembly of the roof was not possible, an enormous jigsaw puzzle of over 6,000 elements with over-dimensioned parts would have been the result. For this reason, eight assembly zones were divided up into individual phases and planned through in subgroups. The roof glazing itself consists of 3,312 triangular panes of different sizes, and these lie directly

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on the steel construction. In order to achieve a pleasant room climate the whole year round, the glazing had to meet extreme standards; the predefined values made it possible to dispense with further measures to provide shade. Yet one of the primary criteria was a smooth exterior, and profiles were not to pierce the external glass surface under any circumstances. The glass used was insulating glass, with 15 mm stepped edges all around. The threaded bolts and the screw-on glass clamping devices disappear in the silicone joint between the adjacent panes, while the glass lies seamlessly on a silicone support profile which is mounted directly on the steel supports and compensates the angle between the panes. Developing a type of insulating glass to comply with the requirements of the planners is an interesting task for the development and application specialists of OKALUX. The far greater challenge for manufacturing and shipping, however, was then the production: producing the 3312 triangular panes with approximately the same dimensions: And every one of these <ETH> absolutely every one <ETH> is however different from the previous one and from the next one, in some cases only by millimetres, in some cases only by one side of the triangle. Producing these accurately and in the right order was the first trick; delivering all 3,312 to the construction site in the specified and correct order was an incredible feat - all in all a really fantastic performance.

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We take architectural glass a step ahead.