Excursion to London

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Our excursion to London in June 2000 aimed at visiting the latest examples of structural engineering and depicting the close relations between Civil Engineering and Architecture. Among various innovative and progressive buildings completed in recent years, the Millennium Dome, the Millennium Bridge and the Peckham Library represent important examples of this close collaboration.

Furthermore, the excursion to London gave us the opportunity to study constructions and construction-details that were known only literately by the students, for instance planar-glazing or membranous-constructions. The excursion was organised by 'Institut für Massivbau' and 'Entwerfen und Konstruktives Gestalten'.

1 Sir Norman Foster

1.1 Stansted Airport

The site we visited first was ‘Stansted airport’, our destination airport, build by Foster and Partners in 1991. Consultant engineers were Ove Arup & Partners. The Stansted terminal building is a spacious, simpel, single-storey building. The guiding principle at Stansted has been to ensure that movement through the building is straight, unimpeded and on one level. The design of the terminal addresses this problem by banishing all services, baggage handling and rail links to an undercroft, leaving the concourse as one zone through which passengers proceed towards departure lounges and thence to shuttle links with the satellite buildings. The main building is characterised by the construction of the roof. The ceiling forms an essential part of the aesthetic appeal consisting of 22,000 triangular ceiling panels, supported within the structural steel framework forming huge pyramid coffers. The roof is supported by a grid of tubular steel structural ‘service trees’, each with four aspiring tie rods. All necessary services are contained in these roof supports, leaving the concourse space free of pipes and ducts. The roof membrane provides indirect lighting due to perforated steel shells and natural lighting through apertures in the roof. The facades are fully glazed. Although the building is a high-tech building, it appears very natural.

1.2 Millennium Bridge

The Millennium Bridge is London's first new river crossing in more than a century. When we visited London, it was still under construction and not opened for the public. The 350 metres-long pedestrian bridge links the City and St
Paul's Cathedral, on the north bank of the Thames, with Tate Modern, the new gallery of modern art on the south bank. The very shallow suspension bridge has been developed in close collaboration with sculptor Sir Anthony Caro and engineers Ove Arup & Partners. Formed by a single sweeping arc, it appears as a thin ribbon of steel. Eight cables, four on either side of the deck, dip just 2.3 metres over the 144 metres central span. The cables are anchored at each end in concrete abutments and supported at two points in the river by concrete elliptical piers. Steel transverse arms support the light-weight deck by clamping onto the cables at 8 metres intervals. This structure is exposed on the underside where it forms a delicate lattice across the soffit.

1.3 Sainsbury Centre for Visual Arts

As the only site outside of London we visited the Sainsbury Center of Visual Art built by Sir Norman Foster with engineers Anthony Hunt Associates in 1977.

1.3.1 Sainsbury Centre for Visual Arts

The building is divided cross-wise by bands of accommodation all unified by the ceiling - a complex layered arrangement of grilles, trusses and catwalks. Triangular towers and trusses house all services, toilets and ancillaries as well as providing a freeway for lighting installations and maintenance. The primary steel structure supports a flexible arrangement of solid or glazed cladding panels. The entire inner wall and ceiling lining is a tuneable system of perforated aluminium louvres. At each end, the steel structure is clearly articulated.

1.3.2 Crescent Wing, Sainsbury Centre for Visual Arts

The Sainsbury Centre was conceived as an open-ended building but the decision to extend it created a dilemma for architects and clients. It was again projected by Sir Norman Foster with engineers Anthony Hunt Associates and completed in 1991. The form of the Sainsbury Centre implies linear growth but the Centre's founders saw it as a finite object, perfect in itself. The most logical course, therefore, was to extend the building below ground. It made sense to extend the basement area, especially as falls in the site would allow the extended basement to emerge naturally into the open, with a glazed frontage to the lake. Because of the sloping ground in front of the building it was possible to incorporate glazing in the form of a curved 'eyebrow' buried in the greenery. The exterior
gives little hint of what lies underneath. A grass lawn, punctuated as it is by rooflights and a narrow side ramp disappearing under the turf, provides a clue but only from the lake is the full extent of the wing revealed in a great sweep of inclined planes of fritted glass.

2 Museums

2.1 Natural History Museum

Within the Natural History Museum we visited the ecology department whose structural alteration was built by Ian Ritchie in 1991. Consultant engineers were Ove Arup & Partners.

The exhibition is located in a longish and old-styled room surrounded by translucend white glass walls. The artificial lighting is dimmed, so that visitors can not perceive the environment at once. The glass walls form a clough in the middle, in which visitors can walk and have a look on the exhibition through the clear parts of the glass. On the higher level, the way runs in loops through the exhibition. Several footbridges cross the clough so that there is a recurring change between in and out. Two bent steel tubes support the steel rips of the construction of the bridges.

2.2 Tate Gallery of Modern Art

Tate Modern stands at the heart of London, linked to St Paul's Cathedral by the New Millennium Footbridge. Built in two phases between 1947 and 1963, Bankside Power Station was designed by Sir Giles Gilbert Scott and has been converted by the architects Herzog & de Meuron until 2000. The building consists of a brick-clad steel structure. The most noticeable change to the exterior of the building is a new two-storey glass structure or lightbeam spanning the length of the roof which not only provides natural light into the galleries on the top floors, but also houses a stunning café offering outstanding views across London. It is only from the inside that visitors can fully perceive the large scale of the building. Herzog and de Meuron divided its massive 200metres length in half. The west entrance opens to the Great Turbine Hall, a space as long and as heigh as the whole building. On the northern side of the building, windowed off from the Turbine Hall, five floors of galleries are accommodated. Most of the galleries are on the narrow side of the building, but this is balanced by large-scale views open up throughout the building.

3 Various Buildings
3.1 Millennium Dome

The Millennium Dome takes place on a 181-acre site on the North Greenwich peninsula bounded on three sides by the River Thames. Part of a 300-acre former gasworks, it had been derelict for more than two decades and was the largest undeveloped site on the River Thames. The Prime Meridian cuts across the north of the site which is about two and a half kilometres from historic Greenwich. The Millennium Dome has been designed by architects, The Richard Rogers Partnership in 1999. The Dome is 320m in diameter and 50m high at its centre. The fabric structure is suspended from twelve 100m high steel masts, held on a net of more than 72 km of high strength steel cable. The roof fabric is self-cleaning PTFE-coated glass fibre with a minimum life of 25 years, which can be renewed in sections if necessary. A two-layer fabric provides insulation to prevent condensation.

3.2 NatWest Media Centre

The recent building at Lord’s Cricket Ground is the NatWest Media Centre completed in 1999. Built by Future System with Ove Arup engineers, NatWest Media Center is the first all aluminium semi-monococque building in the world. It represents a breakthrough, not just in the creation of a new three-dimensional aesthetic but in its method of construction; this building was built and fitted out not by the construction industry but by a boatyard, using the very latest advances in boat building technology. Raised on a concrete column 15m above the ground, the aerodynamic contours of the building reflect the sweep of the plan of the Ground with the enclosing skin formed by a smooth, white, seamless shell. The west facing glazing is inclined to avoid any glare or reflections while providing unobstructed views of the game for the world’s media.

3.3 Waterloo Station

The International Terminal at Waterloo was built by the architects Nicolas Grimshaw and Partners in 1993. It serves the same function as an airport and it has most of the services and facilities normally associated with an airport. At the same time it remains a railway station on a constrained urban site in central London. The roof is 400m long, its tapering span (from 50m to 35m), and its narrow, sinuous plan are determined by the site and the track layout. The striking asymmetry of the trusses derives from the position of a single track on the western edge of the site, and the resulting need for the structure to rise more steeply at this point, to clear the trains.

The structure of the roof is essentially a flattened three pin bow string arch. Because of the asymmetrical geometry of platforms, the centre pin is moved to one side allowing the arch to rise steeply on the west with a shallower incline.
over the platforms on the east. The skin, or cladding, on the structure raised further challenges. Because of the twisting nature of the structure, a standard glazing system would have been extremely expensive, and, involving potentially thousands of different sized and shaped components, would have made construction extremely complex and difficult to achieve within the tight time scale. To overcome this a 'loose fit' approach was adopted, in which a limited number of different sized glass sheets are used, each held in its own frame, and overlapped at top and bottom like roof tiles. They are joined at their sides by concertina-shaped neoprene gaskets which can flex and expand to accommodate turns and varying widths.

3.4 Lloyds of London

The Lloyd's Building, built by Richard Rogers Partnership with engineers Ove Arup & partner, is one of the most famous buildings in London. It was completed in 1986. The Lloyd's Building is located in the most ancient quarter of London. While walking through the neighbouring streets we could already see parts of the glazed facades of the atrium or the service towers which are clad in stainless steel sandwich panels. The most important aspect of the design of Lloyd's Building is flexibility. The building is designed as a series of concentric galleries overlooking a central atrium. All fixed obstructions, i.e. toilets, stairs, entrances, lifts and columns are placed outside the building in six vertical towers. The building is 12 storeys to the north and steps down to six storeys towards the smaller scale buildings to the south, creating a series of terraces at various levels. The twelve glazed lifts are arranged at the outside of the building, inside vertical movement is by a central escalator in the atrium. The servant zones stand freely outside the mass of the building. Concentrating lifts, service risers and toilets into the satellite towers and supporting the main building on external columns gives an uninterrupted space within the enclosing envelope and minimises restrictions on use. The vertical and main horizontal ventilation ducts are run externally for the same reason.

3.5 Peckham Library

The new Peckham Library was designed by the architects Alsop and Störmer and completed in 1999. The main lending library consists of a large double height space raised 12 metres above ground level, supported on one side by angled steel columns, on the other by a vertical block, in which are located a book shop, vertical circulation, staff facilities and a Multimedia training centre. Floating within the double height of the lending library are three "pods" which provide accommodation for the children's activities area, the African - Caribbean Literature Centre and the meeting room. At ground level a new covered public space is created which offers views towards Peckham Square and which will accommodate
open air events. The elevations are clad in patinated green copper, coloured and clear structural glass and ondulation expanded mesh panels.

3.6 Pedestrian Bridge at West India Dock

Unlike Canary Wharf the west side of West India Dock has remained undeveloped up to now. The floating pedestrian bridge was designed by Future Systems in 1999 with engineers Anthony Hunt Associates. It links the two districts and is a formally independent structure based on the pontoon principle. To prevent the bridge drifting out of position, the pairs of pontoons are fixed to tubular steel piles rammed into the bed of the dock. Two segments in the middle can be raised hydraulically to allow ships to pass. Tupper buffers protect the pontoons against the impact of boats.

4 Conclusion

Looking back the excursion was very reasonable and important for all participants. Already during the journey the students discussed architecture and its constructive solutions. The excursion was again an important endorsement to the contents of the teachings of civil engineering.

5 References