AWARD
TERMINAL 5, HEATHROW AIRPORT

an outstanding large structure of elegance and economy

ARCHITECT - ROGERS STIRK HARBOUR & PARTNERS
STRUCTURAL ENGINEER - ARUP
STEELWORK CONTRACTOR - WATSON STEEL STRUCTURES LTD
MAIN CONTRACTOR - LAING O'ROURKE LTD
CONSTRUCTION MANAGER - MACE LTD
CLIENT - BAA PLC

BAA commissioned a new terminal, T5, to handle an additional 30M passengers per annum. The design was a direct reaction to BAA's desire to create a building that would be an aviation landmark and could adapt over time to the ever-changing requirements of the industry. The single span provides a coherent building envelope while remaining independent of the building's internal superstructure.

The roof has a span of 156m and is 396m long. It is supported by 22 pairs of 914mm diameter steel legs that reach down to apron level in dramatic full-height 'canyons' just inside the façades. The scale of the roof's structural components clearly pointed to the use of steel as a way of creating the simple, independent building enclosure. Building movements and deflections for this type of span suggested that only steel construction would be suited.

One of the main drivers was to reduce site work and this was achieved by providing large pre-fabricated units of up to 55 tonnes each that were bolted together at low level to form the central section of the roof. The central arched section of each phase of the roof build was assembled, clad and pre-stressed at ground level and was then strand jacked 30m vertically into position and bolted to the abutment steel. Once each phase was complete the temporary works frames that had been used to assemble the abutments were rolled north by 54m ready for the next phase. Prior to the work commencing on site a full sized trial erection was constructed to refine the fabrication and erection processes and increase the efficiency of both on site.

The arch is formed from steel box girders at 18m centres: 800mm wide and up to 3.8m deep. These are tied at high level by pairs of 115mm diameter pre-stressed steel cables. 914mm diameter steel arms reach up from the tops of the legs to support the rafters, and solid steel tie-down straps from the

judges' comment

This major airport terminal has achieved enormous public recognition for a variety of reasons. The soaring roof, spanning 150m to a height of 40m and 400m long, is truly spectacular. The plated steel roof beams, supporting "trees" and the enormous glazed façades, all show rigorous care and detail control, as well as quality of fabrication.

This well demonstrates the outstanding skills of British construction, and successful structural steelwork.


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rafter ends complete the 3D hybrid portal frame structure. The splices in the central arched section of the rafters always carry net compression. Therefore, they can transfer forces from section to section in bearing. No welding is required. 120mm diameter “male” and “female” shear connectors interconnect during erection so that the whole rafter fits together like giant Lego bricks. As a result the splice is almost completely invisible but is very quick and easy to build.

Fully glazed façades engage the passenger with the romance of air travel but, at the same time, the brise soleil that are used to reduce cooling loads and the heavily insulated Kalzip roof minimise energy use and achieve carbon emissions superior to Part L requirements.

The building's beauty is defined by the simple clear span of the roof which soars 156m from the east side of the building to the west creating two separate “canyons” - each of which responds to the building's functions relative to passenger usage and airport brief. At these areas the roof structure is used to define passenger movement systems and provide scale. Within these spaces the roof supports also act as the façade's lateral support members, creating an integrated building envelope.

The assembly of the huge connecting plates that made up the nodes was a feat of accuracy and materials handling, and the node castings were beautifully patterned and fettled by hand. The finish of both of these was not ground or polished and all the welds were left as laid. This gives the structure a scale and a grain and speaks of the human craftsmanship that has formed it.

The nodes are made from pieces of steel plate that are flame cut to shape and slotted together to avoid site welding and allow a speedy fit up on site. The loads are (almost) always compressive, so direct bearing of steel on steel is an efficient way of transferring forces. However, any angular discrepancy in the fit up could throw the far end of a 22m long member seriously out of position. The bearing surfaces were made cylindrical to allow perfect fit over a range of angles. The geometry and fit of the parts that made up the node were also optimized. For instance, the “teeth” that bear on the central pin are 150mm thick but they are set out at 154mm centres. The nominal 4mm gap allows for the standard supply tolerance on the plate thickness and removes the need for the plates to be machined thus saving time and money in the workshop.


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The construction planning and the structural engineering of this project were so interweaved that it is hard to pinpoint where “design” ended and “construction method” began.

The vast majority of the steelwork is within the building envelope where it is kept dry and at a reasonably constant temperature and so, theoretically, there is no limit to its durability. The roof, by nature of its independence from the building's superstructure, will provide for a fully flexible and adaptable internal space.