The Wellcome Wing at the Science Museum, London

Architect	**MacCormac Jamieson Prichard**
Structural Engineer	**Ove Arup & Partners**
Steelwork Contractor	**William Hare Ltd**
Main Contractor	**Kier Build Ltd**
Client	**National Museum of Science & Industry**

In 1995 the Trustees of the Science Museum decided to extend the museum to provide additional exhibition space and a 3D Imax cinema. A design competition was held, which was won by a team comprising: MacCormac Jamieson Prichard, Ove Arup & Partners, and Davis Langdon and Everest. The winning entry offered a building with spectacular internal spaces which occupied a little over half of the available site and left space for a further building on the Queens Gate frontage. Funding has been provided by the Wellcome Trust and the Heritage Lottery Fund.

The competition concept was for a building supported by two rows of columns, 30m apart, about which were pivoted gerberettes - double cantilevered steel beams, which supported steel floor trusses at their inner ends, and were restrained by tie downs to the ground at their outer ends. The museum's brief required a 5.5m clear height on the exhibition floors, and this system reduces the effective span of the main trusses from 30m to 25m with a corresponding reduction in depth.

The structure has a basement constructed in watertight reinforced concrete supported on bored piles founded in the London clay.

In the four corners of the building are reinforced concrete stair and lift cores which provide horizontal stability. Between the cores are the main building columns, 110 x 750 reinforced concrete, which carry the majority of the building load. There are six pairs of columns, 30m apart, on an 8.5m grid in a east/west direction. They sit 5.5m inboard of the facades on the north and south sides of the building. These main columns span vertically from ground floor to roof level, and the roof slab acts as a beam carrying wind loads and stability loads back to the cores.

The gerberettes extend to the north and south faces of the building where they are held by a vertical "tiedown". The tiedown connects each gerberette on a column down to ground floor level, where the tie force is transferred into reinforcement bars cast into the retaining wall and thence to the foundations. CHS sections are used for the ties, rather than rods, as they are in compression in the temporary condition during erection.

Gerberettes are positioned at the same levels on each column, at a constant dimension below each exhibition floor. The main exhibition trays are supported by 2.5m long trusses, which span directly between pairs of gerberettes. Gerberettes are pinned to the columns and to the ends of the main trusses, so that this basic framework is statically determinate.

The floors comprise 150mm dense concrete on Holorib decking acting compositely with cellform secondary beams at 2.54m centres. The cellform beams span 8.5m between the main trusses and at the front and rear edges of the floors they cantilever 3m beyond the trusses to enhance the impression of the floors floating in the space. The upper exhibition floors only connect to the rest of the building on their north and south edges. On their west side, they stop 3m short of the west wall. On their east sides they stop 6 to 10m short of the underside of the Imax structure, providing a diagonal slot from the ground floor 32m up to the roof which enables the visitor to see the floors and Imax within the overall internal space of the building.

The regular spacing of the gerberettes which support the exhibition trays is maintained for the Imax gerberettes. However the Imax cinema has a more complex arrangement of floors, with floor trusses required both a various levels and between main column lines. In order to connect the trusses to the gerberettes, the inner ends of the Imax gerberettes on each grid line are connected together by steel column sections. Load is therefore shared between these gerberettes, and trusses can be supported at any level. This section of the structure is not statically determinate and the effect of the construction sequence on loadsharing between gerberettes had to be investigated.

The floors in the Imax comprise 130mm concrete on Holorib decking generally, except for the base of the auditorium area where it is increased to 200mm thick to provide acoustic separation. The floors are supported by steel beams, at approximately 2.5m centres, spanning between the main trusses.

The roof structure is similar to the exhibition floors, with a concrete slab on Holorib decking acting compositely with cellcore beams spanning between main trusses supported from the inner tips of the gerberettes. The roof is designed for normal loads on top and the same suspended exhibit loads as the floors.

The West Wall fills the 30m wide by 30m high space between the west cores. It is supported by a structural steel frame, which hangs from the tops of the two cores and obtains horizontal support at floor levels from the core walls. It is glazed internally with blue glass, blue light being a theme of the internal space.

The primary structure comprises tubular steel trusses at main floor levels, which span horizontally between, and transmit wind loads to, the cores. The trusses are supported vertically near their ends and at mid point by a system of vertical and diagonal hangers, which take the vertical load to the top of each core at the end connection of the roof level truss. All other trusses have connections to the cores which slide vertically to allow for temperature effects. Connections to the core are also able to slide in the north/south direction, in order to allow the trusses both to act as simply supported, and to avoid stresses generated by changes in temperature. One connection in each truss does not slide in the north/south direction to ensure positional fixity.

The design assumed a specific erection sequence, which was provided in detail to the contractor, who elected to follow it rather than justify an alternative. The side aisles were erected first, and needed temporary bracing in the north/south direction until the roof slab was cast and provided the permanent support to the top of the main columns. At this point the north and south aisles formed stable independent structures, and the main trusses and secondary beams were erected from east to west by crawler cranes running on the ground floor slab, which was provided with additional temporary propping to the foundations.

Judges' Comment

The multi-level space is organised and defined by a masterly combination of structure and light to create a series of wide span unobstructed floors. These provide a superb environment for the enjoyment of the exhibited material.