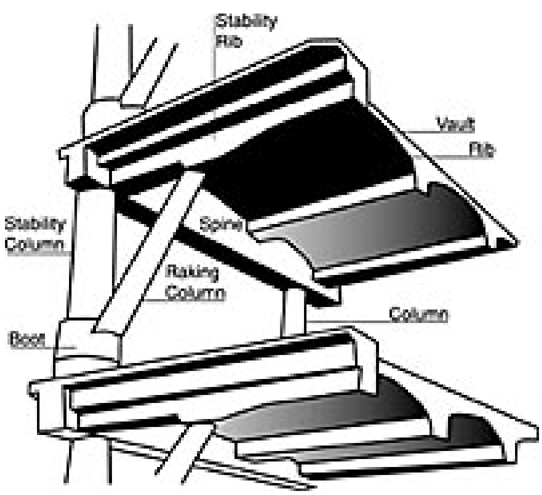
Lloyd's Register of Shipping, London , UK

The new headquarters of the Lloyd's register of shipping involves the redevelopment of a large site in the historic Fenchurch Street area of London. The new building is arranged in a fan-shape with two towers of 10- and 14-stories joined by a 10-storey atrium, together with the retention of some sections existing historic building fabric .

The structure is an exposed precast concrete frame with insitu concrete infill (commonly referred to as a "hybrid-structure"). As columns, slab-soffits and beam downstands were to be exposed, the concrete was required to have an exceptionally high quality finish by the Architect, Sir Richard Rogers.



The floors are vaulted bays with columns at 6m centres in one direction and from 8 m to 10 m in the other due to the taper of the floor plan. Despite the architectural requirement for such a high-quality, exposed concrete finish, the layout may at first seem to preclude precast concrete from consideration as the main structural system. The complex geometry of the building meant that over two thousand panels would be required, with very little repetition in each floor due to geometry. However, the structural Engineers, Anthony Hunt Associates, specified precasting the floor units, columns and bracing elements.

Stability in one plane comes from the distinctive raking columns - the first time that a K-braced building has been designed in concrete in the UK. In the other direction the frame is unbraced, relying on stiffened monolithic joints. All fixings and service holes would have to be pre-located. An additional headache for the design team was that the tower cranes for the site were already ordered, putting a 7.6 tonne limit on the weight of any precast unit.

These problems were outweighed by those of an insitu concrete solution. The column diameter is the same as that of the spine beam. This would have posed major alignment problems with insitu work. Also London, like Sydney, is facing a shortage of skilled carpenters, making it difficult to guarantee the quality of surface finish required.

The geometry, tight tolerances, and accommodation of the sophisticated services in the structure required meticulous attention to detail in the design and exceptional care in construction. The unique combination of precast and insitu concrete meant that a special method of design of the composite thick shells had to be developed, particularly where the connections occurred in zones of maximum stress. The theoretical principals of this method were developed with the assistance of Imperial College, London.

The circular columns are made of precast annular shells with an insitu concrete core. In a new departure, the main reinforcement is cast into the100 mm wall of the unit, but the continuity bars for the connection at each floor are cast into the insitu concrete of the column cores. Long-term differential shrinkage between the column shells and the insitu cores is not thought to be a problem, as the expansion of the shells under load should take up any shrinkage of the core. Short-term differential shrinkage was dealt with by the provision of an expansive (1%) admixture in the core mix.

Exposed fair-faced concrete also plays a major role in keeping the building cool. Air is pumped through diffusers at three air changes per hour in the 450 mm raised access floor. As the air heats up, it rises and gathers in the concrete vaults formed by the precast soffit. Most of the air is cooled as it gathers by a "chiller beam" centrally located at each vault. Holes in the soffit let the remaining hot air escape into the raised floor above. This system is 15% more energy efficient and produces 30% less CO2 than conventional air-conditioning systems.

The curtain walling too is designed to reduce cooling costs. The entire building is clad in full-height glazing by Permistellisa of Italy. The panels are triple-glazed on all external elevations and are fitted with perforated louvres automatically controlled by the building management system. The louvres are fully adjustable: closed to reduce solar heat gain, open for clear views out across the city.

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