ANNEX 3-B

Case study

Landmark building for London at 30 St Mary Axe

A unique high-rise steel framed structure on London's skyline, designed by Foster and Partners, utilises an environmental design concept in which the curved aerodynamically shaped building assists in natural ventilation and enhances the natural light entering the building.

Landmark building for London at 30 St Mary Axe

Built on the former Baltic Exchange site in the heart of London's financial centre, the 180m tall building at 30 St Mary Axe is Swiss Re's new headquarters. The 40-floor building includes a public shopping plaza at ground level, flexible office accommodation and, at the apex, dining and events facilities.

The building has a circular plan that widens as it rises from the ground and then tapers towards its apex (commonly known as the 'Gherkin'). A typical floor has a six-leafed plan around a circular service core with triangular shaped voids that act as light-wells. Social and communal spaces of each floor plate adjoin the voids, thus creating a potential for informal social contact between people on upper and lower floors.

The scheme's glazing wraps around the diagonally-braced structure, providing 694 m^2 of retail space in a double-arcade on the ground floor. The building provides 41,810 m^2 net of office accommodation over 40 floors. At the edge of each floor plate are spiral atria, which promote natural ventilation by using large pressure differentials generated which draw natural air in through horizontal slots in the cladding.

The double-skin energy efficient facade is made of glass, with aluminium profiles and a steel frame. Every sixth floor, the atria feature gardens which control and purify air movements as well as dividing the building into fire compartments.

Application Benefits:

- Structural efficiency
- Building form and orientation
- Operational energy efficiency
- Column free office spaces
- Maximum primary space adjacent to natural light

Project Team:

Client:	Swiss Re
Architect:	Foster and Partners
Structural Engineer	Arup
Main Contractor	Skanska
Steel Fabricator:	Victor Buyck – Hollandia

Communal light wells providing enhanced natural lighting

Construction Details

Arup' engineers addressed the building's radical form by creating the efficient external 'diagrid' system (diagonally braced structure) of intersecting steel sections around the tower's perimeter. The 'diagrid' comprises simple straight circular steel sections resulting in a structure which is remarkably simple to build considering the complexity of the building's shape.

The 'diagrid' responds to the building's curved shape and provides vertical support to the floors thus allowing large internal column free office space. The central core is required only to act under vertical load and is free from diagonal bracing. In addition to being highly efficient in resisting wind forces, the 'diagrid' frames the communal light wells which spiral up the building enabling occupants to enjoy natural light over a larger area of floor.

The internal structure of the building comprises conventional steel beams and columns with composite profiled decking floors. The total weight of steel used is approximately 11,000 tonnes.

The 360 steel 'nodes' or 'junctions' are the key to realising 30 St Mary Axe's distinctive curved form. The key component of these connections are three steel plates that are welded together at differing angles to deal with the complex geometry of the tower's perimeter structure. Each one of these connections is up to 2m high and they link the 2,500 tonnes of steel in the 'diagrid'.

A 3D computer model defining the required steel sizes was used by Foster and Partners to coordinate the overall design and by the steel contractor, to generate the fabrication information for each steel piece required. This process resulted in a smooth and efficient transition from the design to fabrication and ultimately, realisation.

The streamlined tapering form reduces the building's footprint at street level. Wind tunnel testing demonstrated that the tower has a minimal influence on the local wind environment, making it more 'pedestrian friendly by avoiding any unpleasant win effects at ground level often associated with tall buildings.