**STEEL FOCUS: THE SHARD**

Some pointers on reaching the top

The team working on Renzo Piano’s Shard at London Bridge used modular techniques to rise to the challenges of building Europe’s tallest tower.

The Shard is a complex structure, with a steel frame through the off-site assembly of a group of steel frames. The steel frame dominates the building, allowing the steelwork to be assembled independently, especially as there were a lot of relatively small pieces, some only 1.5m long. With winds of more than 100mph, the steel frame had to be designed to withstand the extreme conditions. The structure was designed to have safety, weather and fire zones. The steel frame was designed to be modular and adaptable, with the steelwork contractor Severfield-Reeve Structures involved in the whole design and construction team.

Devising the modularisation was a complex task involving the whole design and construction team including Renzo Piano’s London representative, Giles Reid, who visited the test assembly in Yorkshire.

Some pointers on reaching the top include the following:

1. **Debates**: Early on in the process, the architects were keen to reduce the amount of visible connections. “We’re very conscious that people will be looking up and ... of Renzo Piano Building Workshop. “It was very important to us to push as hard as we could to get a high standard.”

2. **Connecting points**: Where bolted connections couldn’t be avoided, the architects worked with the steelwork contractor to design the connections with coverplates. For example, on the connection between the vertical, horizontal and diagonal bracing, Severfield-Rowen was able to dress the connections with coverplates.

3. **Alignment**: The stair structure was pre-assembled in Sherburn near Scarborough by Severfield-Rowen’s subsidiary company Atlas Ward Manufacturing and Assembly Division. The spire main structure was trial erected in three sections at Severfield-Reeve’s Dalton plant in North Yorkshire.

4. **Safety planning**: As the building rises, the safety planning, design, production and installation of steelwork to a new and advanced level,” says Mace’s Adrian Thomson.

5. **Pamela Buxton**

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**Structural steel stations of the spire**

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<thead>
<tr>
<th>Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>84</td>
<td>Diagonal bracing Severfield-Rowen supported by a steel core structure built to ensure stability. The spire has a steel core structure that holds the glass tips.</td>
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<tr>
<td>85</td>
<td>First the stair tower was installed then the landings were hoisted into place. It was installed complete with aluminium treads, handrails and flooring to ensure the steel core structure was complete.</td>
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<td>87</td>
<td>The stair core structure alone weighs 100 tonnes and consists of 110 pieces.</td>
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<td>89</td>
<td>Trial assembly: The full structure was pre-assembled at Severfield-Rowen’s Dalton plant in North Yorkshire.</td>
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The unconventional geometry of CZWG’s Maggie’s Nottingham is made up of simple steel elements

*Teil Veroje Daxton*  Photographs: Partner Hamilton Knight

A distinctive elliptical steel frame infills the structure for Maggie’s Cancer Caring Centres, designed by CZWG at the Nottingham City Hospital Campus. The centre opened in November with interiors by Paul Smith and is the 15th in the network of Maggie’s centres for cancer patients and their families.

High-quality architecture has always been important to Maggie’s centres, as demonstrated by the starry list of architects already engaged, including Zaha Hadid, OMA and Frank Gehry. That’s why back in 2007, the Nottingham centre was chosen to demonstrate a £7.5 million detailed design of a steel building. The project team included 41 specialists, involving 129 distinct design aspects. The site was a sloping and difficult terrain, providing a secluded environment despite its proximity to other buildings.

The structure gives the impression of floating on a pedestal. The projecting “ears” — two per corner — give the illusion of intersecting but the oval form of the main steel frame actually continues on the smaller basement. The continuous curving lines from the ground level, giving rotation to the overall primary façade, create a layered and visually engaging effect. The building viewed from above reveals a continuous sandglass shape.

The structure, with its overall shape with four floors and a double-height entrance to a central lobby and travel down to a double-height area housing the kitchen, library and meeting rooms, is created at a single-storey height. The roof is planned to arrive at a central lobby and travel down to a double-height area housing the kitchen, library and meeting rooms, then curve around to create a layered and visually engaging effect.


### Care centre’s fearless symmetry

The 360sq m building stands 11m high and is arranged in two storeys within a steel superstructure above a reinforced concrete basement pedestal. The design used higher strength sections in place of standard girders to save cost. Although the building was provided with perimeter bracing, single-strut bracing and grid steel was used in a combination of plates, tubes and structural steel sections. The steel frame has a total weight of 240 tonnes while the post-tensioned concrete slab is 550 tonnes. Detailed design and manufacture were handled by Bowmer & Kirkland Building Services. The structure gives the impression of floating on a pedestal. The projecting “ears” — two per corner — give the illusion of intersecting but the oval form of the main steel frame actually continues on the smaller basement. The continuous curving lines from the ground level, giving rotation to the overall primary façade, create a layered and visually engaging effect.

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The Sustainable Building Envelope Centre has been established to harness the building fabric to generate energy. Here is a look at its ambitions and some of the key technologies under development.

**Sustainability centre finds ways to push the envelope**

The Sustainable Building Envelope Centre (SBEC) building on the Shotton Steelwork site in Flintshire, north Wales, has been split into zones which can be monitored to test new building products.

### Transpired Solar Collectors

Transpired solar collectors (TSCs) work by heating a boundary layer of air that passes through the collector. A radiant floor-deck reduces the need to heat water to high temperatures by utilising the floor area as the radiator. TSCs are essentially passive solar heating systems that don’t require bulky勀eather units.

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### Photovoltaics

Phases embedded in the concrete floor slabs provide the stylish yet highly efficient cooling system. The solar energy absorbed by the photovoltaic (PV) panels is converted into electricity and stored in the building’s energy storage system. This can then be used to power lighting, heating, or other electrical appliances when needed.

### Phase Change Materials

Phase change materials (PCMs) are used in the SBEC building to store and release thermal energy. These materials transition between solid and liquid states, absorbing or releasing heat as they do so. This helps regulate indoor temperatures and reduce energy consumption.

### Heat Recovery

Heat recovery systems are used to capture and reuse the energy contained in exhaust air, which is then redirected back into the building to preheat incoming fresh air. This reduces the need for additional heating systems.

### LIGHTWIGHT PHOTOVOLTAICS

The Lightweight Photovoltaics project is developing lightweight, translucent solar cells that can be integrated into the fabric of buildings. The cells are designed to be lightweight and durable, making them suitable for integration into existing building envelopes. They are intended to reduce the environmental impact of electricity generation while providing a source of renewable energy for buildings.

**Prisma steel (made by Tata Steel) has enhanced thermal absorption properties and absorbs the sun’s radiant energy, heating the boundary layer of air to the exposed side of the metal skin.**

**The Linden Green cassette facade system (left) was installed to part of the SBEC building to heat the offices, while the Anthracite collectors (right) feed pre-heated air into the prototyping bay.**

**The anchoring system is a crucial part of the TSC and involves a stable, customised system that supports the TSCs beneath the crystalline solar module.**

**PHASE CHANGE MATERIAL THERMO ACTIVE FLOOR**