

TATA STEEL



Structural Case Study

St Mary's Sports Centre, London

Product: Celsius® 355 Hollow Section

Client: St Mary's University College

Architect: Rivington Street Studio

Structural Engineer: Michael Barclay Partnership

Main contractor: Morgan Sindall

The elegant new Sports Centre for St Mary's University College at Twickenham was designated an official training centre for the London 2012 Olympics. Designed to inspire athletes, the centre was built speedily and economically. Innovative use of steel hollow section is a key feature. Tata Steel's Celsius® 355 Elliptical Hollow Section is used to striking effect at the centre's strength and conditioning suite. The main sports hall boasts an impressive diagrid roof constructed from circular hollow section.





The challenge

Architect, Rivington Street Studio, was asked to design a new suite of sports buildings for St Mary's University College. The sports centre was to meet the needs and expectations of elite athletes. The project was to be delivered within 18 months and at a cost of no more than £6 million.

The architect's design was for three buildings arranged in a cluster: a large sports hall; a strength and conditioning suite and an administration block. The strength and conditioning suite was designed as a long, undulating form with a large canopy over a common entrance to the sports centre.

The engineer's challenge was to design three structural forms that met the architectural ambition for clarity, simplicity and elegance.

"The buildings also needed to contribute to the user's experience of the facilities," explains Malcolm Brady, Principal for structural engineers, Michael Barclay Partnership. "What's more, the build had to be completed efficiently, speedily and economically.

"There was a further, more specific challenge. Sports halls are often bare internally so it was important to design a solution that was as elegant internally as externally. We wanted to provide more than a 'box' without character – it had to be inspiring."

The solution

The internal, pre-cast concrete walls of the strength and conditioning suite cantilever off the foundations and are independent from the roof. The roof uses engineered timber beams spanning nine metres between undulating steel edge beams.

The edge beams are supported by raked-pairs of Celsius® 355 Elliptical Hollow Section columns. The hot-finished steel columns, in varying lengths up to ten metres, were fabricated in pairs off-site and were easily installed. "The elliptical columns present an

evocative structural athleticism to the building," says Malcolm Brady.

Hot-finished circular hollow steel section is used to form an innovative diagrid roof frame in the main sports hall. It is both an efficient and visually stunning solution. Says Brady: "Portal frames are the usual solution for sports halls. But they are basic, crude and lack imagination.

"We developed and designed an innovative steel diagrid roof frame to span between and be supported by each of the four walls. It was a solution that offered many benefits to the engineering, architecture and construction."

The diagrid is an assembly of sub-frames, all of the same length and depth. They are fabricated from the same circular hollow sections. Each is supported by the other with simple connections made in the middle of the sub-frame.

In-plane stiffness is provided by the combination of frame depth and arrangement and the profile decking fixed to the top chord. It means lateral loads are shed to the four walls without the need for horizontal bracing members. The depth of the structure controls vertical deflections under gravity and environmental loads.



"The resulting structure is light and without clutter. Each element and sub-truss of the steel diagrid roof frame contributes to the performance of the whole roof – maximising the efficiency and properties of the structure and providing a striking containment to the hall."

Malcolm Brady, Principal for Michael Barclay Partnership.

Speed and ease of construction

Swift and efficient construction were prerequisites of the St Mary's Sports Centre project. Hollow steel section played an important role in achieving these objectives – particularly in the construction of the main sports hall.

"Each sub-truss for the steel diaphragm roof was delivered to site pre-fabricated. Being light, they were easily lifted into position and connected in a simple, quick operation," says Malcolm Brady.

Rather than line the steel roof frame with blockwork, pre-cast concrete wall panels were stacked inside of the frame. The panels were clipped to the frame.

Says Brady: "This solution offered quality and consistency through the use of pre-fabricated elements. Importantly, it also allowed the internal envelope to be installed as the steelwork progressed – much quicker and sooner than if we had been using masonry."

The sports centre project – delivering 1,950 square metres of additional space – came in on time and on budget. The centre was opened by Lord Coe in October 2011. Michael Barclay Partnership was 'highly commended' for the St Mary's Sports Centre project in the Association for Consultancy and Engineering 2012 awards.

Photography courtesy of Simon Kennedy



"St Mary's Sports Centre exemplifies the versatility and wide-ranging benefits of Celsius structural hollow steel section. In addition to providing an efficient engineering solution, the use of pre-fabricated hollow section has contributed greatly to the aesthetics of the buildings and helped to ensure a speedy and economical build programme."

Paul Watson, Tata Steel Technical Advisory Engineer.

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