

TATA STEEL



Structural Case Study

NEO Bankside, London

Product: Celsius® 355 Elliptical Hollow Section

Client: Native Land and Grosvenor

Architect: Rogers Stirk Harbour + Partners

Structural Engineer: Waterman Structures

Main contractor: Carillion Construction

Steelwork contractor: Watson Steel Structures

NEO Bankside is a striking residential development on a 1.5 acre site overlooking the Thames and adjacent to the Tate Modern in the London Borough of Southwark. It comprises four apartment pavilions in varying multiples of six storeys. A bold and repeating diagonal pattern of external steel bracing is used on all four buildings – helping to unify the site and performing a crucial structural role. The steel chosen for the bracing was Tata Steel's Celsius® 355 elliptical hollow section.





NEO Bankside appears destined to be listed alongside other iconic buildings of recent decades. With echoes of the ground-breaking design for the Pompidou Centre in Paris, the four apartment pavilions at NEO Bankside proudly display their structural steelwork on the outside. More than three hundred lengths of 200 x 400mm elliptical hollow section criss-cross the building façades in a regular, diagonal pattern.

For the observer on the ground, this bold use of steel bracing results in a striking and memorable visual encounter. Occupants of the pavilions have also been requesting apartments with a clear view of the steelwork from their windows – as if keen to remind themselves that they are dwelling in an architectural masterpiece.

The 'diagrid' bracing is repeated on the same scale across the four apartment pavilions. Two of the pavilions stand at 12 storeys, a third is 18 storeys high and the tallest comprises 24 storeys. The buildings incorporate 217 apartments and penthouses along with triangular-shaped, enclosed winter gardens at each storey level. The diagonals of the steel bracing link the four buildings visually in the vertical plane. They also mirror the geometric ground plane of the pavilions which are constructed in the shape of elongated hexagons.

Aesthetics

The decision to use elliptical hollow section for the steel bracing was prompted by aesthetics and considerations of structural efficiency. Structural engineers for NEO Bankside, Waterman Structures, had used the Tata Steel product before to great effect on a commercial project at Paradise Street in Liverpool.

Regional Director at Waterman Structures, Marcello Marinoni, says: "We opted for elliptical hollow sections very early on when it was first decided that external steel bracing would be adopted. The architects wanted a simple, minimalistic use of steel that would help

to unify the four buildings, a concept that precluded the use of flanged sections.

"We had the benefit of experience in using elliptical sections in the Liverpool One development. Visually, the elliptical section has a softening effect that isn't readily visible in computer-generated images, which may be something to do with the way the light actually plays on the shape of the steel."

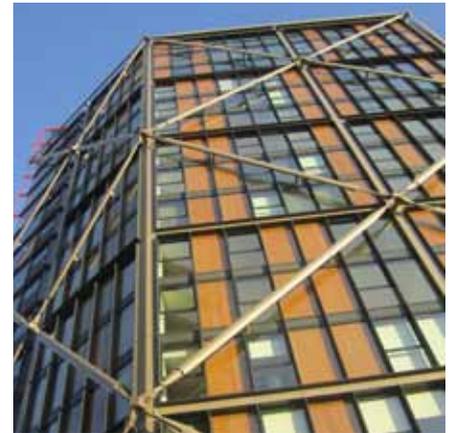
Stability

There was another very important reason for choosing elliptical section. The external steel bracing plays a crucial, structural role - enabling much more freedom in the interior layout of the apartments because it reduces the need for fixed, internal shear walls.

Director of Waterman Structures, Steve Fuller, explains: "In outline, each building comprises a concrete frame of columns and flat slabs which is a common and efficient means of carrying gravity loads in multi-storey residential buildings. But here these frames are stabilised against lateral forces by the perimeter bracing system positioned just outboard of the cladding.

"The steel elliptical hollow sections soften the visual appearance of the bracing and also provide greater structural stability under certain critical loading conditions. The bracing has a dual function. It not only resists lateral building loads but also supports the triangular winter gardens via a series of apex 'nodes' at six storey intervals."

Marcello Marinoni points out that the elliptical section design also has a practical benefit when it comes to building maintenance. He says: "Structurally, we needed the bracing elements to be stiff in one axis only because the braces could be tied back to the building slabs at every floor level. This meant we could limit the projection of the bracing system from the building – making it easier and safer to clean the apartment windows from the



outside, using cradles suspended from roof level."

A fire-engineering study proved there was no need for special treatment of the sections although a level of fire protection has been incorporated in the cladding at node positions. All of the lengths of Celsius® 355 elliptical hollow section were treated with epoxy micaceous iron oxide primer and coated with an acrylic urethane based architectural finish on site.

Each set of four bracing members radiates from a central fixed spindle, with each member terminating at a node embedded into the floorplate. Tata Steel 323.9mm Celsius® 355 circular hollow sections up to 16mm in thickness were used in the spindles. At ground level, the elliptical hollow sections are concrete-filled to resist impact.

"As all Celsius 355® elliptical hollow sections are rolled at fully normalised temperature, they can be designed assuming smaller imperfection factors than cold formed hollow sections. This leads to material cost savings and lighter structures."

Paul Watson, Technical Advisory Engineer, Tata Steel.

Celsius® 355 Circular Hollow Section rises to the challenge



Challenge

The structural system and geometry developed by Waterman for NEO Bankside posed some strong challenges but has resulted in an enormous sense of satisfaction for Fuller, Marinoni and their colleagues.

Says Marinoni: "This project has been 'a first' in nearly every way. The apartment pavilions are hybrid structures of concrete combined with the stability provided by external steel bracing. It's a very unusual approach and I'm not aware of this being adopted on any other residential building.

"Developing the external bracing system was very intensive. We produced around 120 different analytical models and assessed up to 400 loading actions on the buildings. It's been a challenging, exciting and extremely satisfying project. We're all very proud to be involved in a project that is winning a reputation as an iconic development."

Support

Tata Steel worked closely with Waterman to meet its requirements for the steel bracing design. Celsius® 355 elliptical hollow section is produced in standard lengths of ten or 12

metres but can also be produced in volume at any length between nine and 14.5 metres to meet special requirements. For NEO Bankside it was rolled and cut to meet the required bracing member span of up to 13.3 metres. The Tata Steel team also ensured that the sections were produced and supplied to match the NEO Bankside development sequence.

"The Tata Steel technical team also provided very helpful design advice for concrete-filled tubular steel columns which we used at penthouse level in the apartment pavilions," says Marinoni.

Two types of hollow section were used at penthouse level - square hollow section (200 x 200 x 10mm thick) for 'hidden' structural steelwork and circular hollow section (219.1mm diameter x 10mm thick) where the columns are visible. The sections were used with C25/30 concrete and supplementary reinforcement to achieve a capacity of 1515 kN in normal use. The sections were coated off-site with a thin-film, intumescent fire-protection to provide an overall fire rating of two hours.

"We welcomed the opportunity to contribute to this exciting building project that features our elliptical hollow section. Through close liaison with the client, we met the specific requirements for section length and were also able to produce and supply sections to match the NEO Bankside development sequence."

Neil Scott, Manufacturing Manager, Tata Steel.

"Working with Waterman Structures we were able to develop an external bracing system that significantly reduced internal shear structure, thereby enabling different apartment configurations to be easily accommodated. Whilst the resolution of the combined steel and concrete structure was complex, the result is a structure that is both legible and elegant, giving the NEO Bankside development its distinctive appearance."

Graham Stirk, Rogers Stirk Harbour + Partners.

www.tatasteel.com

Tata Steel

PO Box 101, Weldon Road, Corby,
Northants NN17 5UA, United Kingdom
T: +44 (0) 1536 402121 F: +44 (0) 1536 404111
marketing@tatasteel.com www.tatasteelconstruction.com

While care has been taken to ensure that the information contained in this data sheet is accurate, neither Tata Steel Europe Limited, nor its subsidiaries, accept responsibility or liability for errors or for information which is found to be misleading.

Copyright 2012
Tata Steel Europe Limited