TATA STEEL

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Structural Case Study

Jersey Energy from Waste Facility

Product: Celsius® 355 Circular Hollow Section

Client: Jersey Government

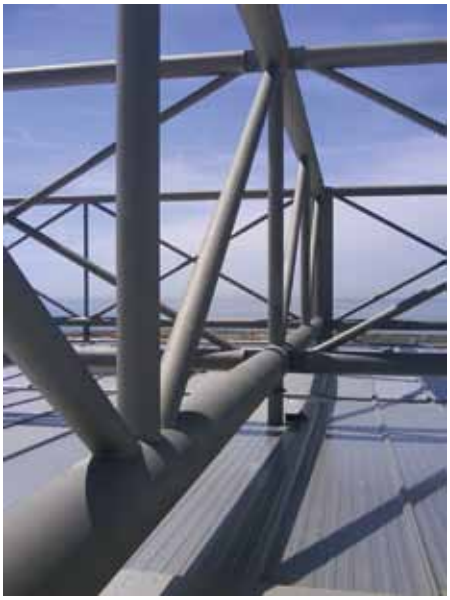
Architect: EPR Architects

Structural engineer: Campbell Reith Hill LLP

Steelwork contractor: Bourne Construction Engineering

Main Contractor: CSBC

The Jersey Government's new Energy from Waste (EfW) facility at La Collette was opened in May 2011. It provides a sustainable solution to waste disposal and produces up to seven per cent of the island's electricity. The landmark EfW building incorporates approximately 1,000 tonnes of steel, largely comprising Celsius® 355 Circular Hollow Section. This lightweight structural steel was chosen for its strength, efficiency and long-span capability.



The challenge

Two new buildings were to be constructed to create the new Energy from Waste facility. The largest building (80 metres x 36 metres x 32 metres high) was the EfW building housing the process engineering equipment. A single storey bulky waste facility was to be built adjacent to the main EfW building.

The prominence of the site – visible from St Helier harbour and Havre des Pas beach – demanded that the EfW building must be of the highest architectural quality. The client's architect, Hopkins Architects, described the concept: "The design of the Energy from Waste building is perceived as a patterned extrusion beneath regularly spaced external trusses, supported on external circular columns, which indicate the clear span created for the plant within."

To help achieve the concept, the structure was expressed externally beyond the EfW building envelope and set to a 16 metre grid. Stephen Ash, Associate at structural engineers, CampbellReith, explains: "This allowed the rhythm of the internal process to be reflected in the external structural arrangement and also for the scale of the building in height and span to be represented in the column and truss engineering."

The design solution

"Given the brief requirements and the geometry of the building, steel was the obvious solution due to the long-span opportunities provided by this high-strength material," says Ash.

CampbellReith worked closely with EPR Architects and Bourne Construction Engineering to develop the concept and deliver the steel frame solution. The exposed frame, constructed from Celsius® 355 Circular Hollow Section (CHS), comprises six 36 metre long roof trusses together with four lines of 16 metre long secondary trusses. These are all supported on 37 metre high, large diameter Celsius® 355 CHS columns at 16 metre intervals.

To make the steelwork as light and efficient as possible, the design team liaised closely with Tata Steel in selecting the columns. Says Ash: "We adopted 864mm x 12mm CHS sections which worked both structurally and aesthetically. The CHS tubes forming the trusses were also varied in thickness to suit loadings and ensure the structures were as light and efficient as possible."

The roof steelwork supports a flat, standing seam composite steel panel roof hung from the external trusses. The end walls are glazed to reveal the structure's bracing. Profiled metal cladding to the long elevations is supported by seven lines of bespoke wind rails over the height of the building. These rails have feature openings and remain exposed beyond the line of the cladding to create patterns in light and shadow. Two vertical McAlloy bars restrain the rails at midspan and connect back to the main roof structure.

Says Ash: "The careful detailing of these elements, together with the superb workmanship in the apparently seamless fabrication, combined to bring about a building structure of the highest quality."

The building received a "commendation" at the 2012 Structural Steel Design Awards.

"Use of circular hollow section allowed us to achieve the long spans required – it's strong but lightweight. The exposed steelwork on the EfW building is also visually effective. The sleekness of the trusses is particularly good."

Stephen Ash, CampbellReith.

The build solution:
Construction and transportation of the large sections of steelwork posed a challenge for steelwork contractors, Bourne Construction Engineering. "We have a proud heritage of delivering complicated and challenging structural steel projects and the EfW building at La Collette is a prime example," says the company's Contracts Director, Nick Hatton.

"The six principal roof trusses posed the biggest fabrication challenge as these were over five metres deep and 26 metres in length," says Hatton. Hatton maintains that the consistent quality, precise tolerances and weldability of Celsius® 355 CHS were an advantage in tackling the steelwork. "It meant we had a regular supply of quality product and accuracy for processing and fabrication," he says.

All the major components were trial fabricated and assembled. Bourne constructed a 25 metre replica bay of the steel frame at its Dorset workshop – complete with principal CHS columns, framing, wind rails and McAlloy rods. This enabled the architects and engineers to finesse the design details.

The final steel structures – weighing in at a total of 1,000 tonnes – were shop-fabricated in large sections and ferried to Jersey. The sections were welded together in an on-site workshop prior to erection – allowing for rapid construction of the frame and cladding.

The steelwork was blasted on site and treated with a protective coating against the hostile marine environment. "We also designed and installed temporary works for lifting and stabilising the 37 metre high columns whilst the trusses were fabricated," says Hatton.

He adds: "The logistics were very difficult and required a lot of planning and liaison. But achieving delivery of such large fabricated sections and components was also one of the most satisfying aspects of this project."

"This large and complex steel structure really does showcase the benefits of Celsius® 355 Circular Hollow Section. It's far more efficient for spanning long lengths than open sections – cutting down on material requirement and fabrication. Because it's a hot-finished tube, there's no distortion when welding."

Paul Watson, Engineer, Tata Steel.

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