Landmark HQ for Co-op

The Co-operative Group’s new steel-framed head office in Manchester will create another architectural landmark for the city and showcase the highest standards in sustainable design and construction.

**Sustainable Credentials**

The Co-operative Group’s new head office is set to be one of the most sustainable commercial buildings in Europe and be one of the first in the UK to be built to the BREEAM Outstanding designation.

By building to the highest BREEAM standard, the group aims to save 40 to 60 per cent of energy costs compared with the group’s existing buildings.

**Key Features Include:**
- Central atrium and a double-skin façade, which is key to creating a more passive approach to heating, ventilation and lighting.
- A combined heat and power plant that uses excess solar to heat and power the building.
- Heat recovery from the atrium and computer systems to heat the building.
- Low energy computer equipment and systems.
- Combined used water and rainwater recycling.
- Low water use appliances.
- High-efficiency lifts.
- Balanced control and energy monitoring to optimise the building’s performance.

**The delivery of comfort conditions to the office floors employs a relatively simple philosophy using passive chilled beams with displacement ventilation.**

- However, enabling this requires a complex array of plant such as combined heat and power and absorption chillers, networked together so that maximum benefit can be gained from energy recovery.

In addition, the building services and structure have been designed together to complement the comfort and energy strategies within the building. Thermal mass within concrete earth tubes and exposed concrete mass throughout the floor plates contributes to a stable, passive and ultimately low-energy environment within the building.

The floor build up is unique to this project, since the structure was tilted at an early stage, the steel was on ground for three floors but finished in phase two.

Since the structure was tilted at an early stage, the outer skin was erected. Its glazed roof is made up of a series of free curved virendeel trusses, which are tied together with a steel-framed lattice arrangement forming an armadillo-shell-type arrangement. Each truss is framed to complement the comfort and energy strategies within the building. Thermal mass within concrete earth tubes and exposed concrete mass throughout the floor plates contributes to a stable, passive and ultimately low-energy environment within the building.

Once it is erected in one phase, the erection gang then moves onto the next phase, leaving behind a frame ready for the precast concrete to be installed.

The notation of trades ensured that a faster programme could be achieved. It was critical that the concrete slab be completed (in the allocated time) so that the next three levels could go on without delay.

**Teamwork requirement**

The solution required careful coordination between the three key trades involved in the floor construction: the steelwork contractor, precast contractor in charge of the concrete units and the concrete contractor responsible for the insitu topping.

**Basic, different trades worked on one third, or phase, of the floorplate at any one time.**

As the steelwork gang finished the first third of the floorplate, the precast contractor could move on to phase two, the next third of the floorplate. At this stage, the precast concrete contractor could begin installing concrete units on the floor before the steelwork in phase one.

As the steelwork gang finished another three floors in phase two, it could move onto the final area of the floorplate – phase three. This allowed the precast contractor to move onto phase two and the insitu concrete contractor to top up the floor on phase one.

With steelwork completed on phase three, the other two trades could move on before the finished phase one floor was ready to receive another layer of roll-forming.

**Steelwork contractor Gerry Richardson:**

- Steel was the natural choice for this framing material, as it gives us the required large column-free floors and the option for future flexibility within the building.

**Steelwork contractor BAM Construction senior site manager Nick Wilde:**

- The building services and structure have been designed together to complement the comfort and energy strategies within the building. Thermal mass within concrete earth tubes and exposed concrete mass throughout the floor plates contributes to a stable, passive and ultimately low-energy environment within the building.

**Steel Spotlight**

**Steelwork contractor**

Fisher Engineering

The Co-operative Group, which can trace its roots back to the Rochdale Pioneers of 1844, has made its name as a socially responsible retailer and is the UK’s largest mutual business, owned by six million consumers. It claims to be driven by “creating value for customers” rather than “making money.

The group is investing £600 million in its new head office in Manchester, which has been designed to the highest environmental standards and is set to create a new benchmark in UK sustainable office design.

Working with contractor BAM Construction, the project is also being used to help train around 300 apprentices on site.

**Staff relocation**

Manchester’s new-framed building will accommodate 3,500 employees who will relocate from eight different less energy-efficient buildings spread around the city. The structure, which has now reached roof level, is the first of many to appear on the group’s £800 million building programme, which is being marketed for redevelopment.

International engineering consultancy Buro Happold and architect 3D Reid have worked hard to produce a building capable of achieving a BREEAM rating of Outstanding. The frame is supported by concrete core columns and precast concrete slabs.

The steel frame is supported by concrete core columns and precast concrete slabs.

A computer-generated image of the completed building
Dr Derek Tordoff is retiring after 35 years with the BCSA, of which 27 were spent as director-general. His career has seen some key developments in steel that have shaped the industry.

** Years of steely determination 

**PROFILE** 

**Ruby Kitching**

Derek Tordoff’s career in the construction industry began with a degree in civil engineering at the University of Leeds. Upon graduating in 1968, he joined consultant Mont Ha & Anderson in Croydon, Surrey, to design satellite support structures using a relatively new invention called a desktop computer. The Olivetti P101 was used to carry out repeat calculations to optimise the structures, which would be located in Hong Kong and East Africa and be subject to hurricane force winds. Although he enjoyed the experience of structural design and computer programming, Dr Tordoff was keen to broaden his knowledge and, as part of his professional training, spent the next year of his career building highways and bridges on the new M62 motorway for main contractor Dowsett Engineering.

When the year was up, Dr Tordoff returned to academia to study for a PhD on the optimum design of steel box girder bridges. Dr Tordoff’s computer skills came to the fore as he adapted software produced for NASA’s space programme for the construction industry. BCSA’s space programme was designed to determine the best spaceframe design for travelling to the moon. Dr Tordoff developed software to bring the work home: developing solutions for steel box girder bridges that satisfied design criteria and were optimised in terms of cost.

He stayed with bridges on his next job as consultant Travers Morgan, where he designed concrete bridges and wrote computer programs to standardise bridge designs for the Department for Transport. His interest and experience in bridge design optimisation was put to good use in 1978, when he joined the BCSA as chief engineer and assisted in the development of the new bridge design code BS 5400. Just prior to this, steel bridge design had suffered a dip in popularity following some high-profile box girder bridge collapses. Fears had been published in response that made designing in steel extremely hazardous.

The BS 5400 code would take these recommendations into account, but in consultation with BCSA, would be more user-friendly so that consultants wouldn’t be put off specifying steel structures.

“At the time, most bridges were made of concrete, so another thing we worked on in conjunction with the DfT was the dual design scheme,” recalls Dr Tordoff. Convincing success

The BCSA convinced the DfT to scheme up a dozen bridge designs in both steel and concrete before putting them out to tender. “Steel bridges came back cheaper in 11 out of 12,” says Dr Tordoff. “That was how we came to steel’s rise in popularity.”

Moving from bridges to buildings, the new steel design code developed for the sector would be ‘the philosophy of structural design from being based on permissible stress-strain limit state, and the BCSA realised again that the complexity of designing in steel was holding back its use. It commissioned computer programs to be written for single-storey and multi-storey structures to aid designers through this transition. The software is still used today under its commercial name, FasTrack.

In 1984, Dr Tordoff became BCSA director general where his role involved a more focused approach towards improving steel’s share of the construction market. Through design aids, seminars, advice to regional technical managers as well as advertising campaigns, the BCSA and the then British Steel (now Tata Steel) worked together to make sure the advantages of using steel were better understood.

Over the years, he has praised the improvements made in health and safety, where accidents and fatalities have fallen by 60 per cent in the last 10 years. But what stands out for Tordoff is the amount of money saved and scope for error reduced. “With confidence.

Steel construction has always had an element of the extraordinary with its height and scale. Steel can be reused or recycled at a very high rate. The BCSA has invested heavily in guides and software to support BS 5950 for the design of steel structures and to help it become recognised as a worldwide benchmark for efficient design. It has also helped the UK to become a world leader in steel construction. The sector is currently offering a similar level of support on the introduction of the Eurocodes for structural design through research, training and design guides.

**1 HEALTH AND SAFETY**

Construction sites are much safer now than they were 35 years ago, especially for the contractor who commonly works from height. A combination of compulsory fall arrest systems and elevated platforms to work from, as well as pertinence safety videos, PPE, BCSA health and safety guides, and tool box talks have helped change the public and site safety culture.

Ten years ago, the BCSA also introduced the concept that a main contractor needed to check that the site was safe for the steelwork contractor to begin working. In issuing a Safe Site Handbook Certifying that the main contractor would verify that the site was safe using a checklist specific to steelwork operations.

**2 FROM FABRICATIONS TO STEELWORK CONTRACTORS**

A fabricator used to be a company which built whatever was specified in drawings submitted to it. Nowadays, these specialists give advice on the most economical way to fabricate elements and on the buildability of structures, providing a complete design, fabrication and erect package. These companies are now better defined as ‘steelwork contractors’.

**3 STANDARD CONNECTIONS**

Before standard connections were introduced, each steelwork contractor would have its own way of doing things. Designers also had their own idea of how they wanted connections designed. By producing standard arrangements in the form of ‘rock up tables’ and latterly software, a lot of time and money has been saved and scope for error reduced.

**4 NATIONAL STRUCTURAL STEEL SPECIFICATION**

Otherwise known as the ‘black book’, this document standardises steelwork specified which previously were bespoke to each consulting engineer. It helped contractors become familiar with what was required and meant that there was less opportunity for error or misunderstanding when standard clauses were used.

Consequently, more effort could be put into understanding where the standard clauses needed to be amended for specific contract requirements.

**5 COMPOSITE CONSTRUCTION AND LONG SPANS**

Composite construction allowed slender floor depths, which from the 1980s at developments like Broadgate, London, started to offer an extra level of lettable floor space. Changed spans that were also possible became favoured by the rapidly growing City market to create larger computer-intensive dealing floors. A column-free environment is now the definition of fit-for-space, allowing many tenants of a building to fit its floors to their own needs.

**6 FIRE ENGINEERING AND LOW-COST FIRE PROTECTION**

Fire engineering has been a major area of growth for the steel sector’s investment into how whole buildings actually behave in fires, as opposed to being based on a single member face in a furnace test. Detailed analysis can now determine that what is required on some members, but may be critical on others.

Also, as the steel industry has grown, better and lower cost protective materials have been developed. A fire-based fire protection coating used to be sprayed onto steel members in a firewall, but now intumescent coatings work more efficiently and are routinely applied off-site to give a cleaner finish.

**7 DESIGN/MODELLING SOFTWARE**

Computer-aided design and manufacture has enabled more non-standard shaped structures to be built. The steel sector has invested heavily in these types of software from very early on in their development, promoting the use of economical non-standard sections and non-standard elements for more extravagant buildings. Steelwork contractors have remained close to the evolution of design and 3D modelling software and most are able to meet ever shorter lead times in times when the manufacturing data is fed directly from the modelling program.

**8 STEEL CONFIDENCE**

One of the strengths of the steel sector has been the collaboration between Tata Steel, the BCSA and steelwork contractors in finding research, and in providing guidance to designers. Thanks to this support, designers are able to work with steel with confidence.

**9 CODES & STANDARDS**

The steel sector has invested heavily in guides and software to support BS 5950 for the design of steel structures and help it become recognised as a worldwide benchmark for efficient design. It has also helped the UK to become a world leader in steel construction. The sector is currently offering a similar level of support on the introduction of the Eurocodes for structural design through research, training and design guides.

**10 SUSTAINABILITY**

Steel construction has always had an element of the extraordinary with its height and scale. Steel can be reused or recycled at a very high rate. The BCSA has invested heavily in guides and software to support BS 5950 for the design of steel structures and help it become recognised as a worldwide benchmark for efficient design. It has also helped the UK to become a world leader in steel construction. The sector is currently offering a similar level of support on the introduction of the Eurocodes for structural design through research, training and design guides.

Steel members can be designed to stay in buildings for as long as they need to. Nowadays, the BCSA is doing a tremendous job of bringing the topic of steel back onto the agenda, as research says the amount of money saved and scope for error reduced. “With confidence.

Steel construction has always had an element of the extraordinary with its height and scale. Steel can be reused or recycled at a very high rate. The BCSA has invested heavily in guides and software to support BS 5950 for the design of steel structures and help it become recognised as a worldwide benchmark for efficient design. It has also helped the UK to become a world leader in steel construction. The sector is currently offering a similar level of support on the introduction of the Eurocodes for structural design through research, training and design guides.

Steel construction has always had an element of the extraordinary with its height and scale. Steel can be reused or recycled at a very high rate. The BCSA has invested heavily in guides and software to support BS 5950 for the design of steel structures and help it become recognised as a worldwide benchmark for efficient design. It has also helped the UK to become a world leader in steel construction. The sector is currently offering a similar level of support on the introduction of the Eurocodes for structural design through research, training and design guides.

Steel construction has always had an element of the extraordinary with its height and scale. Steel can be reused or recycled at a very high rate. The BCSA has invested heavily in guides and software to support BS 5950 for the design of steel structures and help it become recognised as a worldwide benchmark for efficient design. It has also helped the UK to become a world leader in steel construction. The sector is currently offering a similar level of support on the introduction of the Eurocodes for structural design through research, training and design guides.

Steel construction has always had an element of the extraordinary with its height and scale. Steel can be reused or recycled at a very high rate. The BCSA has invested heavily in guides and software to support BS 5950 for the design of steel structures and help it become recognised as a worldwide benchmark for efficient design. It has also helped the UK to become a world leader in steel construction. The sector is currently offering a similar level of support on the introduction of the Eurocodes for structural design through research, training and design guides.
A strict sequence

A tight schedule and a structure with three distinct framing solutions makes building Big Yellow’s storage facility more challenging than it looks.

PROJECT REPORT
RUBY KITCHING
Project Big Yellow self-storage unit, Chiswick, London
Client Big Yellow Self Storage Company
Architect Mountford Pigott
Main contractor McLaren Construction
Structural engineer Campbell Reith
Steelwork contractor Caunton Engineering

Main contractor McLaren is building storage company Big Yellow’s flagship building in London – a gleaming seven-storey steel structure, which to meet the tight 40-week construction programme, has to be built simultaneously on all elevations. As a result, a strict construction sequence is required to ensure that the project safely and on time.

On top of that, special consideration must be given to all site operations, as the work is taking place next to a busy rail line on one side and adjacent to the M4.

The structure is also quite unusual. The steel-framed building is made up of three sections, each with different structural features.

The central section is the most straightforward for steelwork contractor Caunton Engineering, being an eight-storey portal frame structure. Adjoining it is a six-storey section to the west, which is hung from a roof truss and ‘sits’ in line on one side and adjacent to the land and was demolished by contractor 977 Demolition prior to McLaren arriving on site in May this year. The new building occupies about half the site, enabling the constructor to have dedicated fabrication and loading areas and other site facilities.

The two-storey section was first to go up, but with full height west elevation columns, which would eventually support the roof trusses, had to be erected almost concurrently. While the east elevation of the portal frame took shape, the two-storey building to the east of the site gained pace. However, the west end of this two-storey building would block access to the east elevation, so it could only be completed once the west elevation had been structurally completed and clad.

Once the central portal frame was up to full height, three 23 m-long roof trusses were built. These were made up of a 16 m lower section supported off a pile cap spiked on site to 10 m upper section. The 26 m-tall columns would eventually support the 23 m-long steel roof trusses. Tensioned Tifer wire ropes were used to support the columns during erection while the rest of the structure, including the 23 m vierrandle trusses, were built.

Floors were only constructed on the second and fifth floors, since client Big Yellow would install levels three and four and six and seven using its bespoke mezzanine floor system (see box). “The final fit-out also includes the installation of staircases and lifts, which has meant we’ve had to leave openings in the second and fifth floors,” explains Caunton project manager Tareq Abou Qidane.

Beams at each level provided permanent bracing to the west elevation columns. Three 23 m-long trusses were then connected to the roof level steelwork of the central portal framed building at one end and to the top of the west elevation columns at the other. Side elevation columns were then erected.

Swift programme

The erection of the columns took just one week, while the trusses were up in just one day. These 23 m-long trusses travelled in complete lengths from Caunton’s Nottingham fabrication yard to reach the site by 7am on the morning of erection.

Forethought had ensured that the site access ramp from the A4 dual carriageway was wide enough to allow these colossal elements to be turned into the site, rather than having to winch them in from the road.

With concurrent critical path operations on three parts of the site and the entire structure comprising steel elements, mobile cranes were favoured over static tower cranes, McLaren project manager Andy Plail says: “With the amount of hook time needed for all the steelwork and cladding within such a tight programme, we’ve needed up to four 50-tonne cranes at any one time.”

Mobile cranes could be deployed as and when required and were ideal for the majority of members, which weighed less than 5 tonnes. When Caunton’s 40-tonne crane arrived on site, it was lifted into place using a 200-tonne crawler crane. All elements were bolted together on site, since this would be quicker than site-welding. The floor was in situ concrete on a composite steel deck with a power floated finish.

Each element will be sprayed with intumescent fire protection once the building is sealed, a task which will take eight weeks. This is to prevent any particles becoming airborne and reaching drivers on the M4. It was deemed easier to apply the coating after erection to avoid damage during handling. Another quirk of the project was that the west end suspended building with the service yard could not be clad before levels two and five were concreted. “You generally want to get a building watertight first, but here, the building has to be loaded with the concrete first,” explains Mr Plail.

Had the cladding been applied before concreting, it would have caused the weathering steel to move and the cladding to fail. Concreting had just been completed when CN visited the site in late September and cladding was going up fastest. The shell will be handed over to Big Yellow in the new year, with the building opening in May 2012.
Government policy states that by 2019 all new non-domestic buildings should be built to the highest possible environmental standards and with the ability to generate the little energy they need to function – zero carbon in operation.

**Building on Target**

The complete results of a £1 million three-year research programme into how to achieve zero-carbon emissions in five basic building types, that each featured a phase of a five-year study, have just been published. The Target Zero project was commissioned by the British Constructional Steelwork Association and steel manufacturer Tata Steel to offer some guidance on how to go about designing buildings that are also the highest environmental standards. Crucially, the costs of adopting different low- and zero-carbon technologies are presented within the guidance reports, which are available free of charge at www.targetzero.info.

“The government set up a policy to achieve zero-carbon emissions in new non-domestic buildings by 2016 but there is little guidance on how to achieve this,” says Target Zero project manager David Moxon. “What we’ve developed is holistic guidance, which includes the wider environmental issues, tailoring it beyond the steel frame.” The original question asked by BCSA and Tata Steel – “how do we design steel-framed buildings that minimise carbon emissions?” – has been comprehensively addressed in the reports.

Independent consultants Arconic and Cyril Sackett carried out the work, which involved developing five building types based on actual buildings and then theoretically stripping them down to meet the minimum requirements for the 2006 Part L of the Building Regulations. These became the base case buildings.

**On the case study**

Each base case building was adapted to make it as energy efficient as possible in terms of the study’s research. The building’s embodied energy (the energy used to create the operational energy (the energy used to run it), and BREEAM rating – the industry standard for measuring sustainability – for the building. The structure types analysed were schools, warehouses, offices and mixed-use buildings. One of the surprising findings of the study relates to the fact that the choice of framing material, regardless of building type, makes very little difference to the operational efficiency of a new building. So, despite being funded by the steel industry, the study’s findings are as relevant to concrete and timber-framed buildings.

The team designs that are government’s 2012 target to reduce carbon emissions by 41 per cent compared with 2006 levels under Part L of the Building Regulations could easily be achieved in most new buildings using energy-efficiency measures and adaptation of low- or zero-carbon technologies, such as photovoltaics. This would be without significant additional cost.

“There are lots of ways to reduce carbon emissions from new buildings, but achieving zero operational emissions is only part of this approach that is required for truly sustainable design. Attention needs to be given to embodied carbon and the measures that achieve the highest BREEAM ratings, as well as operational energy,” says Tata Steel general manager and Target Zero project sponsor Alan Todd. “Just focusing on one of these aspects and disregarding the others is unlikely to result in a truly sustainable building,” he adds.

The study identifies that one of the strongest scenarios to achieve zero carbon is that of a multi-storey office in a built-up city centre. In those locations, buildings are often surrounded by other high rise and sit on a tight footprint, so there is little opportunity for significant solar power to play a part in offsetting such a building’s heavy reliance on artificial heating, cooling and lighting.

**Solar potential**

The most favourable scenarios for achieving Target Zero are in single-storey large warehouses that can offer large roof areas for solar energy production, says the study. Clearly, some sectors of building design cannot be determined purely by what produces the most sustainable solution – a building’s height and orientation is often fixed by commercial factors or planning regulations, often making it impossible to incorporate a wind turbine or solar power.

However, the reports point to some situations where optimising aspects of design, such as orientation, can have a huge impact on carbon emissions. In the supermarket case study, research found that lighting represented 17 per cent of the total operational carbon emissions for the base case buildings.

**Cost uplift to achieve higher BREEAM ratings**

The most favourable scenarios for achieving Target Zero are in single-storey large warehouses that can offer large roof areas for solar energy production, says the study. Clearly, some sectors of building design cannot be determined purely by what produces the most sustainable solution – a building’s height and orientation is often fixed by commercial factors or planning regulations, often making it impossible to incorporate a wind turbine or solar power.

However, the reports point to some situations where optimising aspects of design, such as orientation, can have a huge impact on carbon emissions. In the supermarket case study, research found that lighting represented 17 per cent of the total operational carbon emissions for the base case buildings.

**Achieving significant reductions in operational energy use**

The study also investigates the current trend for naturally moderating a building’s internal temperature by using its thermal mass. The phenomenon allows heat to be absorbed by the material, usually concrete, releasing it later.

The Target Zero reports reveal that too much thermal mass in a building can actually be detrimental to efficient heating and cooling. It also explains that while it is generally thought that more mass can be included to achieve significant reductions in operational energy use.

The study also investigates the current trend for naturally moderating a building’s internal temperature by using its thermal mass. The phenomenon allows heat to be absorbed by the material, usually concrete, releasing it later.

**end-of-life issues**

The report supports the position that for zero-carbon buildings, embodied energy should fundamentally consider the cradle-to-grave definition. “For me,” it’s critical that the embodied carbon of a building is considered the cradle-to-grave timescale, because the cradle-to-gate concept only coarsens the job says BCSA vice-president and Target Zero project sponsor Robert Burritt. He adds: “Understanding the whole-life cost of a building is essential and to do that you have to look at the end-of-life issues of the building. If you are designing for a 30+ year life of a building – not just the 30 to 40 years of a building itself.”

This description of embodied energy works out favourably from a sustainability point of view for materials such as steel, which are easily reused or recycled when a building is decommissioned. In this respect compared with materials such as structural concrete, it is far less likely to be reused or recycled when a building has reached the end of its life.

Clearly, perhaps one of the most thought-provoking outcomes of the study is in analysing the cost of measures which need to be put into place to achieve higher BREEAM ratings. “It is useful for clients to have a clear idea of the cost implications of achieving higher BREEAM ratings. The Target Zero study shows that across all five building types an Outstanding rating comes at a significant cost uplift, whereas Very Good or Excellent can be achieved at a modest premium,” says Mr Todd.

The report states: “The cost uplift on most buildings to achieve BREEAM Very Good is relatively small. For well-designed buildings, the cost uplift to achieve Outstanding is usually below 1 per cent of the capital cost. But to achieve an Outstanding rating, the cost uplift is over 5 per cent in many cases, for even the best-designed buildings.”

The five Target Zero reports are filled with factual data captured during the study, including lots of tips and guidance to help reduce carbon emissions and design sustainable modern buildings.
One of the most ambitious heritage projects in recent times is under way at Portsmouth Dockyard with the construction of a finely crafted permanent home for Henry VIII’s flagship, the Mary Rose.

**PROJECT REPORT**

**MARTIN COOPER**

**Project** Mary Rose Museum, Portsmouth

**MainClient** Mary Rose Trust

**Architect** Wilkinson Eyre

**Interior architect** Pringle Brandon

**Maincontractor** Warrings

**Structural engineer** Gifford (part of Ramboll)

**Steelwork contractor** Rowecord Engineering

Described as one of Britain’s most important archaeological finds, King Henry VIII’s naval flagship, the Mary Rose, will soon be housed in a new purpose-built museum alongside thousands of objects that were salvaged with the ship’s hull in 1982.

Since being raised from the Solent 30 years ago, the remnants of the ship and its artefacts have captured the public’s imagination, with thousands visiting the current museum in Portsmouth tin yard every year.

The preserved objects offer a unique insight into the life and times of a Tudor warship as many of the artefacts have remained unscarred since the fateful day in 1545 when the Mary Rose sank.

About 1,000 of the 1,900 recovered objects are currently on display in the existing museum – the new facility will have more space for exhibits – while the new facility will have more space for exhibits.

The building’s irregular shape has been formed with a number of faceted columns that rise outwards from the pads, which are isolated from the dock’s stonework by a structural membrane.

The museum takes the shape of a lightning solution meant steel was the only real choice.

BEAUSERRON, GIFFORD

The building’s irregular shape has been formed with a number of faceted columns that rise outwards from the pads and then rake inwards to create the appearance of a ship’s hull.

The complex shape of the structure and the need for a lightweight solution meant steel was the only real choice,” explains Gifford technical director Ben Rowe.

The original design proposed by Gifford was subsequently developed further by Warrings subcontractor CSC. The company has played a significant role in ensuring the steel framework and supports were affordable.

The museum houses not only the original ship and the nearby HMS Victory. The planks will be painted black and inscribed with carvings used to identify their personal belongings.

The dock itself is a Scheduled Ancient Monument, so there was a requirement for minimal interference to the original stonework. Something lightweight was needed, a structural frame which could also span the dock without interfering with the conservation work going on in the midst of the site.

“The complex shape of the structure and the need for a lightweight solution means steel was the only real choice,” explains Gifford technical director Ben Rowe.

The building’s main steel columns sit on pads, which are isolated from the dock’s stonework by a structural membrane. The pads not only protect the dock but also distribute the structure’s loads evenly.

Hull structure

From the dock the steel frame rises up and encloses the hull in an elliptically shaped structure. The frame also includes two pavilions on the north and south side of the structure – one will house the entrance foyer while the other will accommodate an educational suite.

The conservatism work is complete, the hull of the ship has been stabilised, allowing the next bay to be erected.

The museum is connected to the perimeter columns, to form the visitor and object galleries that encircle the museum’s interior. The visitor galleries curve to mimic a ship’s deck and these were formed by staggered beams supporting the flooring.

Truss solution

The lower ground floor of the structure houses not only the hull’s ‘hot box’ but also an area of necessary equipment and plant for ongoing conversation work, as to not to interrupt the important work taking place, two large trusses span this area, forming a large column-free zone.

“The preserved hull of the Mary Rose will finally be unwrapped within its new steel framed home in 2016.”

BEAUSERRON, GIFFORD

The museum takes the shape adjacent to another historic ship, HMS Victory.

*Beauseron. “However, once the bracing – which is curved to match the perimeter shape – was installed, each bay was stabilised, allowing the next bay to be erected.*

More steelwork is connected to the perimeter columns, to form the visitor and object galleries that encircle the museum’s interior. The visitor galleries curve to mimic a ship’s deck and these were formed by staggered beams supporting the flooring.

**Steel Spotlight**

**Ben Rowe, Rowecord Engineering**

“It will be the first time that any of the artefacts have been on permanent display in Portsmouth since 1982.”

The new museum has also been described as a finely crafted, waterfront en-suite hotel, as it will be clad in timber planks both reflecting the structure of the original ship and the nearby HMS Victory. The planks will be painted black and inscribed with carvings used to identify their personal belongings.

Constructing a building which not only encases the ship’s hull but also the dry dock in which it nestles has thrown up a number of construction challenges.

The dock itself is a Scheduled Ancient Monument, so there was a requirement for minimal interference to the original stonework. Something lightweight was needed, a structural frame which could also span the dock without interfering with the conservation work going on in the midst of the site.

“The complex shape of the structure and the need for a lightweight solution means steel was the only real choice,” explains Gifford technical director Ben Rowe.

The original design proposed by Gifford was subsequently developed further by Warrings subcontractor CSC. The company has played a significant role in ensuring the steel framework and supports were affordable.

The building’s main steel columns sit on pads, which are isolated from the dock’s stonework by a structural membrane. The pads not only protect the dock but also distribute the structure’s loads evenly.

Hull structure

From the dock the steel frame rises up and encloses the hull in an elliptically shaped structure. The frame also includes two pavilions on the north and south side of the structure – one will house the entrance foyer while the other will accommodate an educational suite.

The building’s irregular shape has been formed with a number of faceted columns that rise outwards from the pads and then rake inwards to create the appearance of a ship’s hull.

The complex shape of the structure and the need for a lightweight solution means steel was the only real choice,” explains Gifford technical director Ben Rowe.

The original design proposed by Gifford was subsequently developed further by Warrings subcontractor CSC. The company has played a significant role in ensuring the steel framework and supports were affordable.

The building’s main steel columns sit on pads, which are isolated from the dock’s stonework by a structural membrane. The pads not only protect the dock but also distribute the structure’s loads evenly.

Hull structure

From the dock the steel frame rises up and encloses the hull in an elliptically shaped structure. The frame also includes two pavilions on the north and south side of the structure – one will house the entrance foyer while the other will accommodate an educational suite.

The building’s irregular shape has been formed with a number of faceted columns that rise outwards from the pads and then rake inwards to create the appearance of a ship’s hull.

The complex shape of the structure and the need for a lightweight solution means steel was the only real choice,” explains Gifford technical director Ben Rowe.

The original design proposed by Gifford was subsequently developed further by Warrings subcontractor CSC. The company has played a significant role in ensuring the steel framework and supports were affordable.

The building’s main steel columns sit on pads, which are isolated from the dock’s stonework by a structural membrane. The pads not only protect the dock but also distribute the structure’s loads evenly.

Hull structure

From the dock the steel frame rises up and encloses the hull in an elliptically shaped structure. The frame also includes two pavilions on the north and south side of the structure – one will house the entrance foyer while the other will accommodate an educational suite.

The building’s irregular shape has been formed with a number of faceted columns that rise outwards from the pads and then rake inwards to create the appearance of a ship’s hull.

The complex shape of the structure and the need for a lightweight solution means steel was the only real choice,” explains Gifford technical director Ben Rowe.

The original design proposed by Gifford was subsequently developed further by Warnings subcontractor CSC. The company has played a significant role in ensuring the steel framework and supports were affordable.

The building’s main steel columns sit on pads, which are isolated from the dock’s stonework by a structural membrane. The pads not only protect the dock but also distribute the structure’s loads evenly.

Hull structure

From the dock the steel frame rises up and encloses the hull in an elliptically shaped structure. The frame also includes two pavilions on the north and south side of the structure – one will house the entrance foyer while the other will accommodate an educational suite.

The building’s irregular shape has been formed with a number of faceted columns that rise outwards from the pads and then rake inwards to create the appearance of a ship’s hull.

The complex shape of the structure and the need for a lightweight solution means steel was the only real choice,” explains Gifford technical director Ben Rowe.

The original design proposed by Gifford was subsequently developed further by Warnings subcontractor CSC. The company has played a significant role in ensuring the steel framework and supports were affordable.

The building’s main steel columns sit on pads, which are isolated from the dock’s stonework by a structural membrane. The pads not only protect the dock but also distribute the structure’s loads evenly.

Hull structure

From the dock the steel frame rises up and encloses the hull in an elliptically shaped structure. The frame also includes two pavilions on the north and south side of the structure – one will house the entrance foyer while the other will accommodate an educational suite.

The building’s irregular shape has been formed with a number of faceted columns that rise outwards from the pads and then rake inwards to create the appearance of a ship’s hull.

The complex shape of the structure and the need for a lightweight solution means steel was the only real choice,” explains Gifford technical director Ben Rowe.

The original design proposed by Gifford was subsequently developed further by Warnings subcontractor CSC. The company has played a significant role in ensuring the steel framework and supports were affordable.

The building’s main steel columns sit on pads, which are isolated from the dock’s stonework by a structural membrane. The pads not only protect the dock but also distribute the structure’s loads evenly.

Hull structure

From the dock the steel frame rises up and encloses the hull in an elliptically shaped structure. The frame also includes two pavilions on the north and south side of the structure – one will house the entrance foyer while the other will accommodate an educational suite.

The building’s irregular shape has been formed with a number of faceted columns that rise outwards from the pads and then rake inwards to create the appearance of a ship’s hull.

The complex shape of the structure and the need for a lightweight solution means steel was the only real choice,” explains Gifford technical director Ben Rowe.

The original design proposed by Gifford was subsequently developed further by Warnings subcontractor CSC. The company has played a significant role in ensuring the steel framework and supports were affordable.

The building’s main steel columns sit on pads, which are isolated from the dock’s stonework by a structural membrane. The pads not only protect the dock but also distribute the structure’s loads evenly.