Structural Steel Design Awards 2017

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The British Constructional Steelwork Association Ltd
4 Whitehall Court,
Westminster, London SW1A 2ES

Tel: 020 7839 8566
Email: postroom@steelconstruction.org
Website: www.steelconstruction.org
www.steelconstruction.info

INTRODUCTION

This year's entries demonstrate that steel is, as always, the structural material of choice across the complete range of buildings, infrastructure projects and other structures.

The high quality and effectiveness of the entries to the Awards scheme is genuinely impressive and demonstrates the resilience and responsiveness of the constructional steelwork sector. They also illustrate admirably the versatility of steel, in providing designers with an effective means of satisfying the widely different and exacting requirements of their clients.

It is hoped that the high quality, visually stimulating, yet cost-effective projects presented here will provide inspiration and generate interest in steel construction and all that it has to offer.

THE JUDGES

D W Lazenby CBE DIC FCGI FICE FIStructE – Chairman of the Panel
Representing the Institution of Civil Engineers

R B Barrett MA (Cantab)
Representing the Steelwork Contracting industry

J Locke MBE FREng DEng MSc CEng FIStructE FWeldI
Representing the Steelwork Contracting industry

C A Nash BA (Hons) DipArch RIBA FRSA
Representing the Royal Institute of British Architects

Professor R J Plank PhD BSc CEng FIStructE MICE
Representing the Institution of Structural Engineers

W Taylor BA (Hons) DipArch MA RIBA FRSA
Representing the Royal Institute of British Architects

O Tyler BA (Hons) DipArch RIBA
Representing the Royal Institute of British Architects

OBJECTIVES OF THE SCHEME

"...to recognise the high standard of structural and architectural design attainable in the use of steel and its potential in terms of efficiency, cost-effectiveness, aesthetics and innovation"

AWARD

The Leadenhall Building, London

PROJECT TEAM

Architect:	Rogers Stirk Harbour + Partners
Structural Engineer:	Ove Arup & Partners Ltd
Steelwork Contractor:	Severfield
Main Contractor:	Laing O'Rourke
Client:	C C Land

© Paul Carstairs/Arup

The Leadenhall Building is a 224m high steel-framed commercial office tower in the City of London. In order to meet the client's aspiration for a landmark tower on this sensitive site, the architects proposed a wedge-shaped building. This produced the highest office floors in the City, while minimising the impact on a cherished view of St Paul's Cathedral.

The use of steel is fundamental to the value of this building. It is visibly integrated into the architecture to an extent that is highly unusual for a skyscraper, creating a powerful tectonic quality which enables people to appreciate and take delight in the way that the building is constructed.

Panoramic lifts were placed on the vertical north elevation so they could serve all the office levels. As a result there is no central core, and stability is provided by the perimeter braced steel 'megaframe' placed outside of the building envelope.

This steel design allows the floors to be exceptionally open, with views in every direction and spans of up to 16m, so that there are only up to six internal columns within floorplates of up to 43m x 48m, making them very flexible and attractive to tenants.

At the bottom of the building, floors are cut away and hang from the levels above, creating a vast open space, the 'galleria', which connects and relates directly to the surrounding public realm, regenerating the local environment and creating new pedestrian routes.

The architects wanted the building to express its engineering systems wherever possible. This significant challenge demanded a holistic and creative approach,

with the engineers and architects working closely together from the outset. The most striking example of this is in the 'megaframe'. Alternative bracing arrangements were proposed, studied and then optimised, leading to an arrangement that is both structurally efficient and architecturally coherent. Vertical columns are provided where they are most needed, on the east, west and north faces, and a diagrid structure on the more lightly-loaded south face. Connections are made through a family of separate fabricated node pieces. This ensures that the complex geometrical relationships between members are always resolved within welded joints and the site connections remain simple and standardised.

Within the 'galleria', floor beams are exposed, enhancing the character of the space. At level 5 these project beyond the 'megaframe' to form a canopy over Leadenhall Street. The levels below are suspended via hangers whose bespoke end connections provide a seamless transition between the rods and the supporting steel beams.

The 'megaframe' columns and braces around the 'galleria' are unrestrained over a height of 28m. Standard 'megaframe' sections are therefore subtly adapted, with tapering webs and additional stiffening plates, to significantly increase their buckling resistance without undermining the node connection principles or aesthetic proportions.

Steelwork is corrosion protected and fire protected where required. In external areas, epoxy intumescent coatings are employed for durability. Cast intumescent caps were placed over the ends of the 'megaframe' fasteners to preserve the 'nuts and bolts' aesthetic.

The most complex steelwork details were developed in workshops based around Arup's Tekla BIM model. The model fed directly into the procurement process where it was used to explore the construction methodology and co-ordinate the temporary works. It also fed directly into the steel fabrication models, driving automated shop processes.

JUDGES' COMMENT

This project had a committed client, architectural and engineering excellence, fabrication precision and construction ingenuity and innovation. They all combined to make a project whose achievements are even greater than the sum of the parts.

Structural steel is rigorously controlled to generate an architecture that is clear and legible throughout the building. Like most ground-breaking projects there were lessons to be learned, but the client and the team persevered to achieve final success.

This world-class project is an exemplar for large commercial buildings.

80% of the building was constructed offsite, reducing waste and improving quality, safety and programme.

All wet concrete was eliminated above level 5 by replacing conventional composite floor slabs with an innovative precast concrete panel system. The panels have pockets which enable dowels to be installed into the neighbouring units via cast-in couplers to provide diaphragm action. These dowels pass through circular openings in shear tabs pre-welded to the tops of the steel beams, to provide the required shear connection.

The primary steel system within the north core was built as a series of storey-high tables, with the services and concrete floor slabs pre-attached to them, minimising the number of crane lifts required.

The building was predicted to move sideways to the north during construction. An innovative approach was deployed to counter this, known as 'active alignment'. The structure was initially erected straight and movements regularly monitored. At a later point, adjustments were made to the 'megaframe' diagonals which pulled the building back sideways, reversing the gravity sway. This allowed the 'megaframe' nodes to be fabricated with a simple orthogonal geometry and improved the overall accuracy of construction.

The Leadenhall Building provides the public with a unique and dramatic new space at ground level, offers tenants some of the most desirable office spaces in the City, and forms a sensitive and elegant addition to London's skyline.

AWARD

T-Pylon

PROJECT TEAM

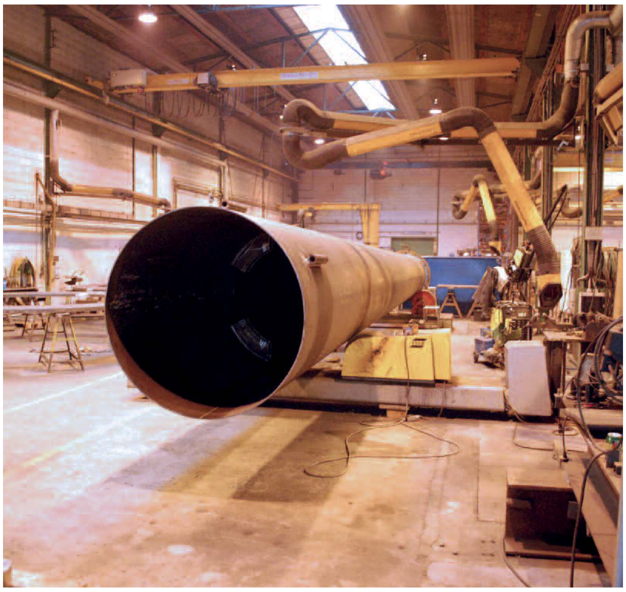
Architect:	Bystrup
Structural Engineer:	Bystrup
Main Contractor:	Balfour Beatty Power Networks
Client:	Nationalgrid UK

The T-Pylon is a structure of only few parts that can be erected quickly and requires virtually no maintenance. It is designed to carry 2 x 400kV, but can be modified to alternative specifications, and is the result of a design competition in 2011 to find a 21st Century power pylon design for Nationalgrid UK. The challenge was to find an alternative to conventional lattice towers that minimised the visual impact on the landscape, whilst being cost-effective and functionally superior.

The use of steel for the T-Pylon has allowed for unique geometries. Contrary to conventional lattice tower designs, the arms of the T-Pylon are slightly raised, which gives the pylon a more optimistic and positive appearance. The few parts making up the pylon have been welded together and subsequently painted white. The tower design is shorter and leaner than traditional lattice towers resulting in improved aesthetics and reduced environmental impact. The use of a monopile foundation also minimises the overall cost, installation time and environmental impact of the T-Pylon.

The alternative design using steel has made it possible to obtain the aesthetic and functional goal, which is to minimise the visual impact on the surrounding landscape, while also providing an economic and durable solution.

The steel structure is designed in accordance with Eurocode 3 and fabricated in accordance with BS EN 1090-2 to Execution Class 3. The structural steel specification for the flanges, monopole and transition piece is for S355J2 to BS EN 10025-2 for thicknesses up to and including 50mm, and either S355NL to BS EN 10025-3 or S355ML to BS EN 10025-4 for thicknesses over 50mm. The steel plate also has to be accompanied by a Type 3.1 specific inspection certificate according to BS EN 10204.



A radical innovation is the re-assessment of the conductor/cable arrangement. The prismatic configuration of the cables allows a reduction in the pylon's height of more than 30%. The footprint of the power lines, as well as the electro-magnetic field (EMF) radiation, is thus reduced.

The most remarkable characteristic of the T-Pylon design is that all conductors are carried by a single attachment point. Traditionally, such a structure would have three separate arms - each carrying an individual conductor.

This unique attachment point was studied closely to ensure its robustness and resistance to fatigue. Complex analysis and physical loading tests were carried out to simulate climatic conditions such as extreme winds and ice loads. Investigations were made into the dynamic performance of the structure under simulated vibrations.

The pylon is made from S355 steel plates that are curved and welded to form cylindrical sections. The shaft is fabricated in either one or two pieces according to the length needed, the requirements for hot dip galvanizing, and transport limitations. The steel plate thickness used for the shaft is optimised according to the design load cases and varies from 22mm at ground level to 14mm at the top.

At the top of the shaft a cast node connects the shaft to the two arms. The node is cast in one piece to ensure the optimal load transfer from the arms to the shaft. The result is a highly effective and smooth node that transfers the shape and forces from the arms to the shaft. The node is connected to the arms and shaft by non-visible internal bolts.

Dynamic external wind loads experienced on the pylon arms result in a bending moment at the pylon foundation. However, the cast node must withstand the transfer of internal stress from compression and tension at the node due to the pylon arm distributed load case. The cast node is designed to withstand both the magnitude and the dynamic behaviour of the load case.

At the end of the arms another node connects the insulator configuration to the arm in an aesthetically pleasing way. Again, the node is connected to the arms by non-visible internal bolts.

For the UK market the pylon is hot-dip galvanized and painted light grey. This duplex coating system gives the pylon an expected lifespan of at least 80 years. For other markets the pylon can be produced in stainless steel or weathering steel.

The design of the shaft is similar to the design of towers for wind turbines. Consequently, it was possible for the steelwork contractor to use the experience from wind turbine towers to produce the shaft using automated processes in controlled factory conditions. Maximising the offsite fabrication simplified on-site operations and reduced the number of operatives required for the installation process.

The new designs have significantly reduced maintenance requirements compared to traditional lattice towers. The durable coating system and lack of edges and bolted connections increases the future maintenance intervals and makes re-painting the towers much faster. Also, no anti-climbing devices are needed for the monopole shaft, which would otherwise require frequent replacement.

JUDGES' COMMENT

The T-Pylon represents a generational step change in power transmission hardware. Analytical design from first principles included re-examination of arrangements for insulation and maintenance.

The result is a family of compact pylons which can be deployed in sensitive landscapes, with prefabrication enabling consistent finish, smaller land take and speedy erection. This is a steelwork design classic.

AWARD

LSQ London

PROJECT TEAM

Architect:	make
Structural Engineer:	Waterman Structures
Steelwork Contractor:	Bourne Steel Ltd
Main Contractor:	Multiplex Construction Europe Ltd
Client:	Linseed Assets Ltd

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LSQ London is a Grade II listed building refurbishment, which required over 2,000 tonnes of structural steel and metal decking to be installed within what is thought to be Europe's largest retained façade. Situated in London's busiest tourist area, this project required meticulous planning and organisation to ensure the most efficient use of time and craneage without bringing the surrounding streets to a standstill.

The completed building was erected to the required tolerance of 15mm over the full height, making this project challenging for the engineering and delivery teams, but was completed on time, to budget and to the client's satisfaction.

The existing building envelope is partially retained with new upper storeys of commercial floor space being provided. The design delivers two basements, two floors of retail space and seven floors of high quality office space with a new entrance on Whitcomb Street. Upper floors are enclosed by a new curved mansard roof. On the lower floors, new retail space has created active frontages at street level with new, clearly defined entrances.

The contemporary roof design is supported by a structural steel-framed central core and new perimeter stanchions, with complete column-free office space and spans of up to 12m providing very efficient floor space to appropriate market standards.

A new two-storey basement was created by the installation of a secant piled wall inside the retained façade profile. Shallow floor construction was used for the B1 and ground floor slabs to maximise headroom in below ground spaces, whilst minimising excavation depths.

The project was designed using Revit 3D modelling techniques to capture the integration and interfaces of both architecture and building services. This assisted the design and construction activities, but also provides full integrated models for future use.

The design of the building naturally leant itself to using steel for the primary structural elements. The design of the new steel structure introduced a new central core, and enabled clear, open-plan floorplates improving the office spaces within the building. One of the key aspects of the façade retention scheme was the alignment of new floors with existing window openings. This was assisted by integrating the suspended services within the structural downstand beam zone, such that the depth of floor zone against the façade was minimised. The use of a steel frame offered the flexibility needed to suit the various interfaces that occur with the existing façade.

The steel-framed façade dates from the 1920s and 1930s, however some areas were added during the 1960s. The steel columns are all encased in Portland stone and consequently in good condition. However, steelwork originating from various decades required extensive laboratory tests to determine its make-up and suitability prior to making the welded connections for 250 new façade retention brackets. This demonstrates the adaptability of steel-framed structures both old and new.

The new fifth floor is clad with Portland stone to integrate with the retained façade below. This floor level's steelwork is topped with a ring beam that goes around the entire perimeter of the building.

The ring beam is formed from jumbo box sections measuring 650mm × 450mm with a 25mm thickness. The sections were brought to site in 3.5m long sections each weighing three tonnes. The box section ring beam performs two functions, one is to support the columns for the feature roof as these are not aligned with the main columns for the rest of the building, and the second function is for the stone cladding panels for the sixth floor as they are hung from the beam.

The steel feature roof slopes outwards from the two centrally positioned cores and is formed with a cranked steel frame, which in turn supports a lightweight aluminium frame and glazing. This new and elegant curved mansard roof encloses the building and offers a modern interpretation of the traditional mansard style where arch geometry sits atop a classical base. This respectful, contemporary addition to the building composition reduces the existing top-heavy visual mass of the building and, with the curved design, also seeks to ensure the building blends in seamlessly with the surrounding iconic buildings of Leicester Square.

JUDGES' COMMENT

The use of structural steel for the new internal structure, including cores, enabled new clear-span floorplates to be achieved, whilst respecting the existing listed façade. It minimised disruption during construction in London's busiest tourist area.

With its graceful three-storey 'top-knot', the building has a new lease of life as a striking yet respectful landmark in the West End.

This project showcases the role steelwork can play in the extension and re-purposing of historic buildings.

AWARD

HGV Egress Ramp, Selfridges, London

PROJECT TEAM

Architect:	Gensler
Structural Engineer:	Expedition Engineering
Steelwork Contractor:	William Hare
Main Contractors:	Blue Sky Building and SRM JV
Client:	Selfridges

© Kevin Sansbury 2015

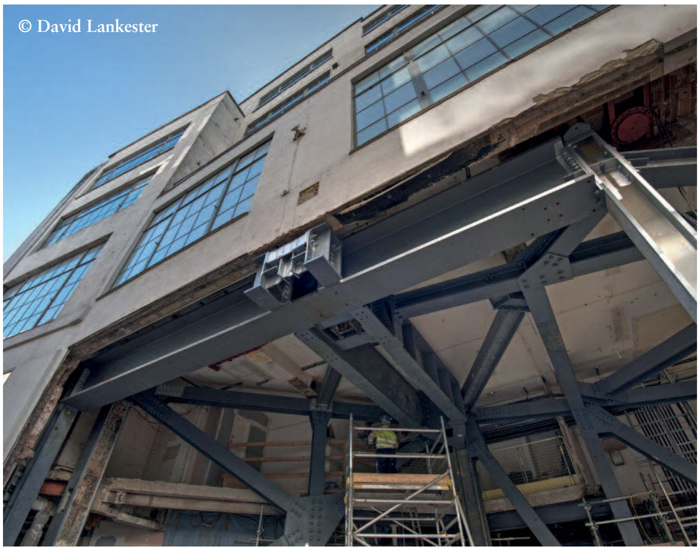
The Duke Street phase of the redevelopment project included forming a new staff entrance into the building below Edwards Mews and realignment of the HGV entrance ramp to the loading bays. However, the primary feature of the first phase of works was the insertion of a new 50m long 165 tonne steel-framed bridge structure, through the existing store, to improve HGV egress from the basement loading bays. This new structure is a braced steel tube linking the loading bay within the basement to Duke Street.

The structural works were designed to keep the loading bay active throughout the works, while staff access was maintained and retail operations continued within 1m to 2m of the structural works.

Design and execution of the structural interventions was made more complex by the limited existing building information, and numerous historical alterations that were discovered during the build, requiring modifications to be made to the new construction as it progressed on-site.

To maximise retail space for the client, the preferred routing of the egress ramp was tight to the perimeter of the building. This routing allowed the ramp to be partially supported on the existing steel structure, but necessitated the partial removal of three existing columns that then had to be re-supported on bespoke steel transfer girders integrated into the new ramp structure.

The routing of the ramp meant it would span over an occupied three-storey basement. To minimise disruption to these basement spaces, and to minimise the need for new foundations, support was taken from the existing 1920s steel structure along the northern edge of the ramp. On the southern edge of the ramp vertical support was limited to two new columns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between which a new steel truss would span. The new columns were threaded down through the existing building and supported on new hand dug pad foundations.

Reuse of the existing 1920s steel frame on the northern edge of the ramp provided an economic solution. The existing steelwork comprised of built-up riveted sections, which geometrically added complexity to the connections, formed to the existing structure. However, the existing steel proved to be of a weldable nature and so site welded connections were adopted.

Where the new ramp is supported on existing steel columns, these were checked for a change in loading and restraint condition due to the removal of the ground floor beams. Some of the columns required strengthening but, as this was governed by buckling capacity, the columns could be strengthened relatively simply via the addition of welded plates to the existing sections to increase their stiffness. The size of the strengthening plates could be easily tailored to suit constraints on site and manual installation.

To allow the ramp to connect between road level and the loading bay within the basement a large slot was cut into the existing ground floor slab. The stability of the building is likely to be provided by a combination of frame action and some contribution from the masonry infilled building cores. The unquantifiable nature of the system meant the diaphragm action of the ground floor had to be maintained. This was achieved in the temporary condition via a temporary propping arrangement, and in the permanent condition by making connections between the existing ground floor frame and new ramp. The new ramp structure was then designed to transfer any diaphragm loads back to the existing retaining wall, with steel members being tuned to provide an appropriate stiffness.

The two transfer structures used to re-support the columns above the ramp were deemed to experience vertical deflections exceeding acceptable limits for an occupied building. However, to negate the existing structure above experiencing these movements, an erection approach utilising jacking was adopted. This allowed the load from the existing column sections to be transferred into the new transfer structures in advance of the lower column sections being removed. The jacks were used to push the transfer structures down, realising the anticipated deflections before connections were made to the existing columns.

A key challenge in the construction of the new steel ramp structure was the fact that it was to be constructed within a live existing building. As the structure was to support HGV vehicles the steel forming the structure was of a scale that, although lighter than other forms of construction, could not be manhandled. The contractor team therefore developed a series of temporary works that spread the load of a spider crane across the existing suspended basement floor. The crane could then be safely driven into the space via the existing loading bay entrance without back propping through the levels below.

The creation of the new egress ramp was a highly complex piece of engineering design and construction successfully delivered by close collaboration between the whole team.

JUDGES' COMMENT

The creation of this new egress ramp within an existing steel structure was highly complex, yet successful. A key challenge for the engineering design and construction was that the work was to be carried out in a live and busy existing building, with ongoing high-end retail operations being immediately adjacent to the work zone.

The outstanding success of this complex project was achieved through very close collaboration between the whole design and construction team.

AWARD

Oriam, Heriot-Watt University, Edinburgh

PROJECT TEAM

Architect:	Reiach and Hall Architects
Structural Engineer:	Engenuiti
Steelwork Contractor:	J & D Pierce (Contracts) Ltd
Main Contractor:	Bowmer & Kirkland
Client:	Heriot-Watt University

© Reiach and Hall Architects

Oriam, Scotland's new Sports Performance Centre, comprises a full size indoor 3G synthetic pitch for football and rugby with spectator seating for 500 people, a nine-court sports hall, a 100-station fitness suite, as well as a high performance wing that includes areas for hydrotherapy, strength and conditioning, rehabilitation, offices and a classroom.

Oriam presented truly fantastic opportunities to be creative. With long spans and a simple but elegant diagram, the cross section forms the principal structural concept. Steel arches at 7m centres span over the football hall and sports hall from buttresses on each side onto a central street of piers.

The arch profile for the football hall roof offers a high rise : span ratio and considerable curvature, giving rise to a highly efficient structure with a comparatively low overall weight. The arch is a naturally efficient form allowing the structure to work primarily as axially loaded, with relatively small bending moments generated.

Tensioned PVC fabric was chosen to clad the football hall roof as it offered the necessary light transmission properties so as to limit the need for artificial lighting of the pitch space, whilst managing heat gain. It was also preferable in the structural design, given that the fabric is lightweight and forgiving to structural movements and deflections. The diagonal arrangement of arched secondary CHS members ensured that the fabric shape could be prevented from flattening under heavy imposed loading, whilst also creating interest to the roof form itself.

The sports hall roof comprises steel arches on a 7m grid, with straight secondary steel members spanning between the arches, and curved tertiary steel members spanning between secondary beams to provide intermediate support for the roof cladding. In this case, the original trapezoidal section was re-engineered to work as a standard UB section, further increasing the material and prefabrication savings.

Central piers support the ends of the football hall and sports hall arches, which converge at a single point behind the listed wall in an area known as the Street. Initially these piers were conceived as reinforced concrete elements. However, the overall programme advantages of bringing this element within the steel package were explored and, following this review, the steelwork option was selected giving both programme and cost advantages.

The roof structure acts as an umbrella over the public fitness area and high performance wing, which are both constructed as conventional steel-framed structures and accommodate the high performance spaces and the public fitness suite, café and accommodation. In the public area the tight limitations on available floor depths meant that cellular floor beams were needed to span the full width of the structure without intermediate columns, leaving the gym and café spaces completely column-free. The same was needed in the high performance wing in order to maximise the column grid spacing and minimise the disruption to the floor layouts.

The roof arch is formed from three curves meeting at tangents and, whilst this is stable once vertical, it has little structural strength in its minor axis. This meant that building the trusses flat on the ground and then lifting them vertically would require extensive temporary works, which with 13 to lift would have substantially increased the build costs. Building the trusses vertically on the ground was ruled out due to the height of any temporary frames which would have been required for temporary stability during assembly.

The solution was to utilise the permanent design for the temporary works. Simple stubs were designed to transfer the load from truss to truss with chord ties, and then match all these stubs at each truss so truss components could be connected directly to the previous truss; this allowed a full truss to be built in the air. The challenge was then how to erect the first truss! As this was at a gable the slender gable posts, which were themselves trussed, could be propped first and then roof truss segments landed on top and joined together to form one complete arched truss.

All the steel structural elements were very precisely fabricated to tight tolerances before delivery to site, which enabled a rapid waste-free assembly and a comparatively quiet construction process.


© J & D Pierce (Contracts) Ltd


© Reiach and Hall Architects

This was important as the existing Centre and Academy buildings needed to remain open during the construction work. Erection procedures were planned in detail using 3D models.

The steel-framed structures and regular column grid arrangement for the office, café and elite sports areas are all adaptable for future changes of use.

The structural steel was efficiently engineered for fire resistance with the structural elements supporting floors required to achieve a 60 minutes' fire rating. For exposed elements this was achieved through the use of high visual quality intumescent paint. For those which are not exposed, intumescent paint with a basic finish was used.

The project team has delivered a world-class facility that also provides extensive access for the local community.

JUDGES' COMMENT

Two parallel vaulted forms spring from a central spine; the larger one covers a football pitch, whilst the smaller covers a sports hall. The elegant lightweight steel trusses resulted from a collaborative effort by the designers and contractor, with the construction methodology informing the roof structure and supports from which it springs.

Striking and effective steelwork.

COMMENDATION

The Curve, Slough

PROJECT TEAM

Architects:	BBLUR architecture and CZWG architects
Structural Engineer:	Peter Brett Associates
Steelwork Contractor:	Caunton Engineering Ltd
Main Contractor:	Morgan Sindall
Client:	Slough Borough Council

© David Butler

The Curve initiative is a major development comprising a mixed-use, vibrant community facility with multi-functional spaces and wider cultural offerings, based around the arts with opportunities for performance and exhibitions.

The 90m long x 15m high building's form, a curved 'tube,' features fully glazed entry façades, and opens onto two new public squares created at each end of the building.

A heavily serviced building with a single two-storey enclosed plant area presented particular challenges in incorporating horizontal distribution routes within the building. The composite steel frame allowed floor depths to be kept within a stringent floor zone, whilst allowing for the services' distribution.

The composite steel solution allowed for full flexibility in the design of an irregular column grid, and provided minimum depth cantilever façade support sections. The aesthetic of the circular hollow section columns has been retained and expressed throughout. The double height performance space required column removal, for which composite universal column sections were able to achieve the spans in the shallowest depth possible. The constrained site utilised a single mobile crane to perform all lifting operations in a carefully planned three phase construction sequence, allowing free site areas open to other trades.

Detailed 3D modelling allowed efficiencies to be gained in specifying a constant bend radius for the façade members, and limiting the supporting tubular transfer beam to three discrete bend radii. This 45m curved CHS beam was then spliced using carefully detailed non-visible connections. Curved edges to the internal atrium required cantilever decking sections to arrive at site with the bend radii pre-cut. Staircases, both front and back-of-house, were formed offsite in steel and installed quickly and prop-free to open up the site to the follow-on trades. Detailed 3D model coordination allowed for accurate placement of pre-applied cladding fixings and secondary support steelwork.

A shop applied painted system provided the corrosion resistance to the members. Fire resistance throughout was provided by intumescent painting of the main structural members up to the 120 minutes' period required in some areas. The design methodology to use bolted connections reduced the risk of compromising steel coatings that can occur when site welding is required.

JUDGES' COMMENT

Part of the implementation of the masterplan for the regeneration of Slough Town Centre, The Curve provides popular and accessible community facilities. Its striking curved form arose from its proximity to a church and probably could only have been achieved by an integrated team using coordinated BIM design, analysis, fabrication and erection.

Elegant and effective steelwork meets unusual demands.

COMMENDATION

West Croydon Bus Station

PROJECT TEAM

Architect:	Transport for London
Structural Engineer:	Price & Myers
Steelwork Contractor:	B&W Engineering Services Ltd
Main Contractor:	Quinn London Ltd
Client:	Transport for London

© Alex Upton

© Alex Upton

West Croydon Bus Station has been transformed from an unsightly, uninviting and poorly functioning 1980s 'shed' into a customer-friendly landmark that supports the regeneration of Croydon. The old building has been replaced by an open concourse under an elegant weathering steel canopy. The canopy wraps around and connects two small buildings – a retail unit and a bus operations building.

The choice of materials was carefully considered to reduce whole life costs. The primary material of the project is weathering steel, and is used throughout the canopy structure in combination with translucent Kalwall panels, creating a structure requiring minimal ongoing maintenance.

The weathering steel canopy wraps around the two brick clad buildings, tying the station architecture together on the linear site. The brick and weathering steel were chosen to complement the surroundings. The style and natural flow of the station achieves this while also providing an interesting play of light, shadow and texture. Timber seating and planters are fully integrated into the steel canopy structure, along with customer information and lighting to minimise visual clutter.

The canopy is based around a repeating module where canopy and supporting columns are linked by a curved haunch. This haunch is perforated with variable sized holes to both create interesting visual effects and demonstrate the changing stress intensity across the haunch.

Guttering, downpipes and lighting have all been integrated into the structure to ensure services are not visible nor impact on the final impression of the structure.

The buildings are highly sustainable and environmentally friendly - with solar panels, air source heat pumps, LED lighting and building materials that maximise the buildings' performance. A building management system ensures energy efficiency and reduces light pollution.

The opaque canopy provides natural lighting and manages glare and heat transfer. Night lighting on the canopy creates an attractive and safe environment.

The whole life value of all aspects of the design was assessed to inform design decisions, such that:

- The weathering steel of the canopy reduces maintenance and future carbon impact.
- The design modelled different climate scenarios and was carefully detailed to minimise waste during the build.
- Prefabricated insulated timber panels reduced on-site labour and the energy required to mechanically condition the buildings throughout their lifetime.

Anti-social behaviour was a significant issue at the old bus station. The new improved open layout, architectural lighting and soft landscaping tackle this issue and create a safer, more socially sustainable, environment.

JUDGES' COMMENT

High quality design and careful selection of materials, with low maintenance a major objective, are evident in this project. The lightweight canopy is framed in weathering steel, carefully prepared and detailed, to provide visual interest.

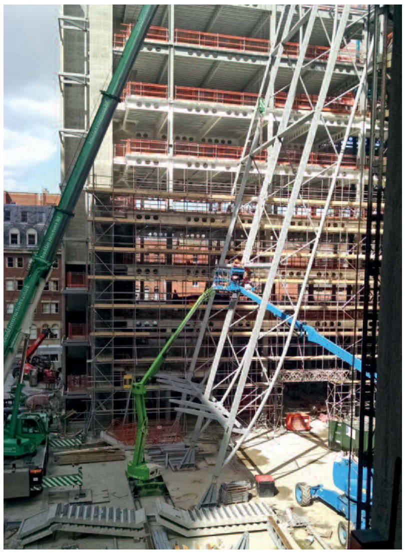
This is a facility which has transformed passenger experience and provided a significant contribution to the environment.

COMMENDATION

Central Square, Leeds

PROJECT TEAM

Architect:	DLA Design
Structural Engineer:	WSP
Steelwork Contractor:	Elland Steel Structures Ltd
Main Contractor:	Wates Construction
Client:	M&G Real Estate



Central Square is a 20,400m² development, providing 18,700m² of Grade 'A' offices with 1,700m² of retail, leisure and health/fitness.

The scheme provides office accommodation on 10 floor levels and is said to have the largest floorplates available in the city. These are arranged so that they can be subdivided, providing the occupier with both flexible and highly efficient floor space. The development offers an outdoor Sky Garden on the level nine, providing entertainment opportunities and views across the city. In addition, a stunning seven-storey fully glazed atrium houses Central Square's Winter Garden, where the created contemporary square offers a mixed-use destination for members of the public throughout the day and evening to enjoy the high quality public realm, retail and leisure facilities on offer.

Sitting above a two-level concrete basement, the steel frame forms a U-shaped structure with the central void occupied by the fully glazed Winter Garden created by the glazing sloping down from the underside of level eight within this central void.

In total five 27m long tubular 'vertical' bowstring trusses, which were delivered to site in two pieces, form this indoor zone. These trusses, carrying heavy dead load from the attached glazing, are pin connected at the base to architecturally exposed fabricated base assemblies.

The heaviest steel assembly on the project was the 43 tonne, storey-high, Vierendeel truss that supports level eight's balcony that overlooks the Winter Garden. The Vierendeel truss, comprising heavy UC members, was brought to site in individual sections that were then assembled on the ground before being lifted into place by a 300 tonne capacity mobile crane.

The majority of the steelwork was erected using the site's tower cranes, with two erection teams being employed that divided the structure in half and erected the frame three levels at time, incorporating placing and subsequently fixing of the metal deck flooring. Each of the U-shaped structure's tips contains one of the building's three cores, and this provided each erection team with an ideal and stable starting point. From these outer concrete cores each of the teams worked its way to the centre of the structure, meeting up at the third centrally positioned core.

Above the lower levels of retail and leisure, the offices begin at level two and extend upwards to level 12. Levels two up to seven are identical, with a central portion positioned inside the Winter Garden. The reception for the offices is positioned at level one and accessed via a feature escalator, with the upper levels being accessed by a number of lifts including two glass-clad wall climber lifts.

JUDGES' COMMENT

Central Square is a landmark office and leisure complex within two minutes of Leeds City Station. In this BREEAM 'Outstanding' development, the floors are supported on long-span beams enabling 25,000ft² floorplates, the largest in the city.

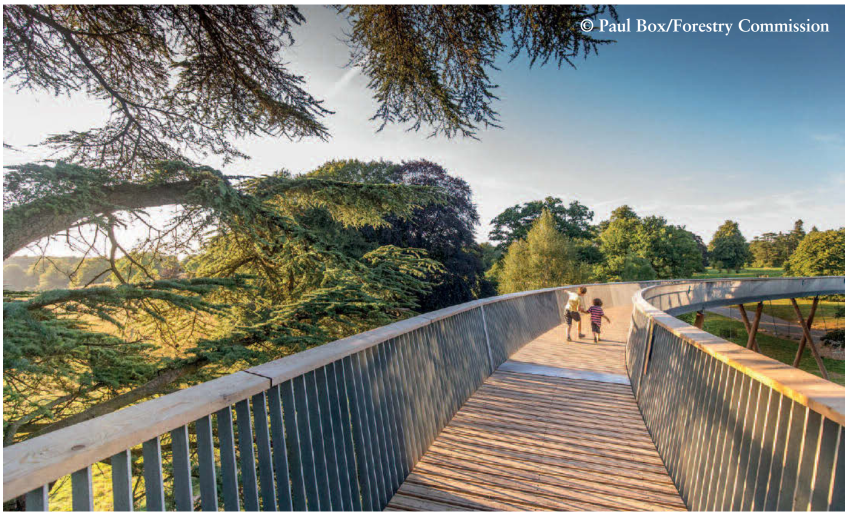
The ground and first floors are accessed through a large atrium 'winter garden', forming a new and exciting part of the public realm in the area.

COMMENDATION

STIHL Treetop Walkway, Westonbirt, the National Arboretum

PROJECT TEAM

Architect:	Glenn Howells Architects
Structural Engineer:	BuroHappold Engineering
Steelwork Contractor:	S H Structures Ltd
Main Contractor:	Speller Metcalfe
Client:	Forestry Commission, Westonbirt, the National Arboretum


© Paul Box/Forestry Commission


© S H Structures

The STIHL Treetop Walkway is the longest structure of its kind in the UK. Reaching heights of up to 13m, the walkway transports visitors effortlessly on a journey through the park's Silk Wood.

The structural solution that developed is a hybrid timber and steel structure. The basic structure is a simple arrangement of two perimeter beams supporting the 1.8m wide deck and the balustrades. These beams are formed from curved galvanized steel RHS sections which, with the CHS cross beam, create a laterally stiff structure to transfer loads back to the supports. The use of galvanized steel provided the required stiffness and allowed a shallower deck profile to be created with something that was durable and maintenance-free.

Building the walkway using small assemblies and single elements enabled the size of the construction equipment to be reduced and allowed the use of bolted connections throughout, meaning that future dismantling would be straightforward.

Various support solutions were considered due to the unique constraints of the site. The chosen solution was to use shallow reinforced concrete pads supporting pairs of inclined timber legs at 10.5m centres. The inclined columns provided a more natural feel and allowed the base positions to be easily moved in plan to avoid areas of heavy root coverage.

The client was keen to accentuate the treetop experience by having a degree of movement, and the use of a non-linear dynamic model of the structure enabled an acceptable behaviour to be achieved.

The walkway is punctuated by a number of independent platforms, such as the Crow's Nest, which serve as educational areas. The ability to curve the hollow steel sections to a very tight radius enabled the architect's requirements to be achieved. Whilst the main walkway is inherently stable, the cantilevered Crow's Nest is somewhat more lively, providing visitors with the more dynamic experience requested by the client.

Four different capacity cranes were used during construction, including a mobile tower crane which provided the required reach over the trees. Mobile cranes of up to 350 tonne capacity were used in other locations where prepared bases were constructed in areas that would cause the minimum impact.

The construction followed a repetitive sequence with the pairs of columns being installed first. The columns were temporarily supported with guy lines fixed to concrete kentledge blocks. This methodology enabled the column heads to be positioned correctly whilst causing no damage to the trees and their roots.

JUDGES' COMMENT

Owing much to the romantic tradition of great English landscapes this sinuous walkway carefully winds through the canopy of ancient working woodland, whilst avoiding the precious root zones. A 'tuneable' structural system addresses the varying dynamics and geometrical restraints.

The curvilinear route, which heightens the sense of drama and discovery, was facilitated by the use of steel. Apparent simplicity conceals sophistication in this project.

COMMENDATION

The Hurlingham Club Racquet Centre

PROJECT TEAM

Architect:	David Morley Architects
Structural Engineer:	Price & Myers
Steelwork Contractor:	Tubecon
Main Contractor:	ISG
Client:	The Hurlingham Club


© Metsä Wood

The state-of-the-art Racquet Centre replaces an existing marquee structure and has modern functionality practical to its purpose. Designed to meet high standards of sustainability, it fits sympathetically into its rural surroundings. The Centre is home to four indoor and two outdoor tennis courts, four squash courts, a multi-use games area and changing facilities.

Steelwork was the natural and most cost-effective material, due to the long spans needed by the large 38m x 70m column-free space required by the tennis hall.

A series of tied-arched steel frames, tied with large diameter bespoke tension bars, at 16.5m centres form the primary roof structure. These purpose-engineered welded box sections were paired together to also act as Vierendeel trusses to help distribute horizontal forces back to vertical bracing systems. Further efficiencies of the arch were gained by portalising the structure and providing raking ties at the roof ends, which help minimise the depth and weight of the box sections.

These arches support timber stress-skin panels which span between the arches. The structure is predominantly internal; however, where the structure becomes external, an offsite painted protection system with a life to first maintenance of 20 years has been used and, where necessary, with a decorative top coat. By using steel, the main elements could be fabricated offsite while the groundworks were completed. This prefabrication meant a fast erection process on-site and also assured a high quality finish – imperative as the majority of steelwork is left architecturally exposed.

A key consideration was how the timber panels would bear and tie to the steel frame without visible fixings, and what tolerances would be needed. Creating the primary arches from welded plates allowed the bottom plate to provide a bearing ledge for the timber panels, which were tied to the tops of the steel with steel straps and self-tapping screws to allow them to be completely concealed. Designed to be transportable, the trusses had to be fabricated in three sections with bolted splices connected on-site using a seating jig. Once connected, a tandem lift then raised the 40-45 tonne trusses into place, which cantilevered approximately 2m-3m.

With architecturally exposed steel, all processes required acute accuracy and highly skilled workmanship, from detailing and connection design through to the fabrication and erection process.


© Price & Myers

JUDGES' COMMENT

A detailed, yet compact, building adds generous new indoor play areas, whilst meeting the requirement for a low profile at the edge of the Club grounds. The stringent dimensional and technical constraints were answered by well-coordinated structure, services, equipment and enclosure.

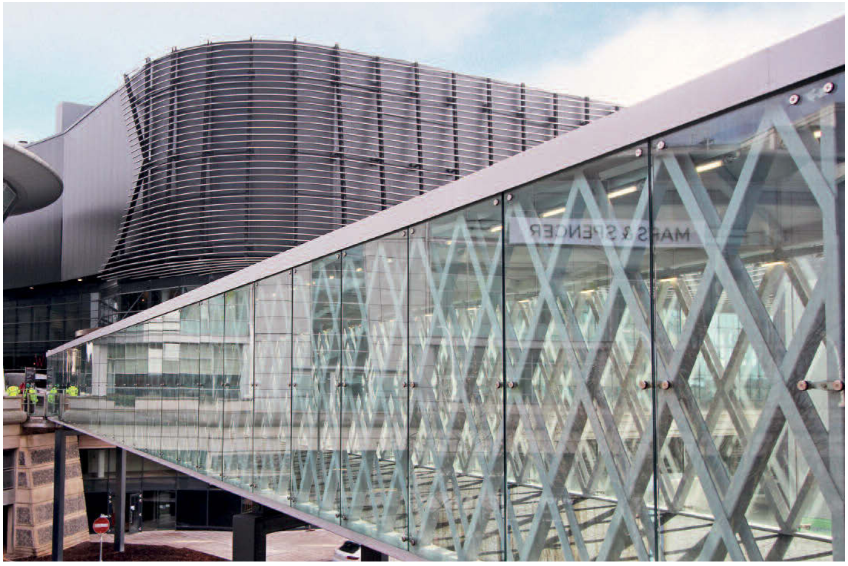
Steelwork again enables elegance and efficiency in modern sports facilities.

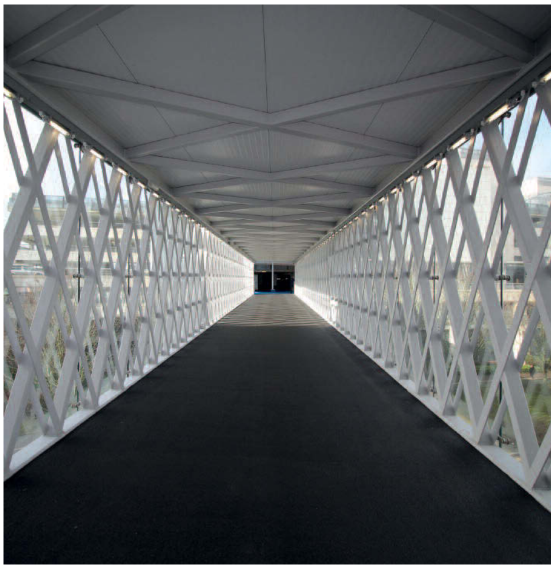
COMMENDATION

Watermark Westquay Footbridge, Southampton

PROJECT TEAM

Architect:	ACME
Structural Engineer:	David Dexter Associates
Steelwork Contractor:	S H Structures Ltd
Main Contractor:	Sir Robert McAlpine Ltd
Client:	Hammerson plc





The footbridge provides enclosed pedestrian access from an existing car park that serves the old West Quay shopping centre complex in Southampton over Harbour Parade and directly into the new Watermark retail centre.

The bridge is a box truss cross braced on each face which is an efficient structural approach to both giving an enclosure, and achieving the spans of 30m between column supports and a 10m cantilever at the existing car park end.

For the truss sidewall bracing, RHS diagonal bracing elements are used in the idealised compression direction with paired plates lapping these in the idealised tension direction.

The challenge with the detailing was to achieve a uniform appearance throughout the length of the bridge. Thicker RHS bracing elements are used at the support locations with subtle local stiffening. Narrow and thick-walled chords (200 x 200 SHS) were used to give a visually shallow profile. The bottom chord is internally stiffened at the support cross beams to ensure the line of the chords is not visually broken.

The horizontal bracing to the box truss' roof and floor is in a similar, but less dense, pattern to the sidewalls and is formed with RHS elements of equal size to the RHS wall bracing. A steel deck floor is employed with an anti-slip deck treatment applied.

The vertical supports to the structure are 500 x 250 RHS steel hoop frames, which are independent of the existing car park and new shopping centre structures at each end, and are located to minimise disturbance to the considerable amount of underground service routes in the vicinity.

The footbridge was fabricated and trial assembled within the factory before being separated into two sections for delivery to site. Installation took place during a closure of Harbour Parade enabling a 500 tonne capacity mobile crane to be positioned close to the bridge position.

To facilitate securing the first bridge section in its temporary condition a temporary trestle was installed on the bridge centreline. The top of the trestle was fitted with hydraulic jacks to enable the final lowering of the bridge to be carefully controlled.

With the first section in place the second section was lifted into place. A temporary connection was integrated into the truss members that aligned the two sections, holding them in place until the joint was fully welded.

The use of steel resulted in a lightweight structure that could be quickly erected from prefabricated component parts, minimising the need for temporary works and road closures.

JUDGES' COMMENT

The pedestrian link from parking into the shopping centre was necessarily economical. This latticed box girder bridge does the job without fuss. The diagonal geometry of the faces is composed of both welded flats and tubes, reflecting the forces carried. These support the glass cladding and filter sunlight most elegantly.

A simple and economical concept has been beautifully executed.

MERIT

A400M MRO Facility, RAF Brize Norton

PROJECT TEAM

Architect:	AWW Architects
Structural Engineer:	Arup
Steelwork Contractor:	Billington Structures Ltd
Main Contractor:	Balfour Beatty
Client:	Defence Infrastructure Organisation

The 22,000m^2 three-bay maintenance hangar based at RAF Brize Norton in Oxfordshire was built to service A400M and C17 military transport aircraft. In addition to housing three aircraft in bays equipped with overhead cranes, the building contains specialist workshops together with parts stores, offices, welfare and mission planning functions. The design and build was heavily constrained by the demands of the airbase, in particular the need to avoid interference with radar and aircraft guidance systems.

A metallic blue colour was chosen for the building to reflect the colour of the sky and complement the natural surroundings.

A large rounded cladding profile was chosen to soften the building's form to help break down the hard edges of the building. The building has an A rated EPC, BREEAM 'Excellent' rating, and achieved an air pressure test rating on first pass of 1.98m^3/h/m^2, which is all the more remarkable bearing in mind the size of the hangar doors which are up to 64m wide and 20m high.

The impact of the building on the operational environment of the airbase was carefully considered. A radar impact assessment indicated the need for radar diffusing cladding at high level on the sides of the building facing the runway. Modelling was necessary to prove that PV panels on the roof would not cause glare to pilots from reflected sunlight.

The main building's structure is a steel-framed construction with the roof consisting of primary girders spanning up to 67m supporting secondary trusses. This allows the hangars, stores and workshops to remain column-free spaces. The roof supports the rails of a number of travelling cranes. Supporting the cranes directly from the roof structure avoided the need to provide additional steel columns for crane runway beam support, thus increasing the usable ground floor area. The design of the roof was carefully developed to ensure that the deflection of the primary roof structure would be compatible with the deflection limitations of the cranes.

The use of a 3D BIM model was especially beneficial in the complex 3,000 tonne frame as it allowed the structural engineering team to rapidly assess coordination areas, such as secondary cladding support and crane runway beam setting out. The 3D structural model was issued to the steelwork contractor, where it was invaluable in early tonnage take-offs and construction programming and phasing.

This functional building at RAF Brize Norton is also aesthetically pleasing and sympathetic to its surroundings.

JUDGES' COMMENT

This 22,000m^2 three-bay maintenance hangar was built to service specific military transport aircraft, with the roof having main girders spanning 67m. The design and construction were heavily constrained by the operational demands of the airbase, particularly avoiding interference to radar and aircraft guidance systems.

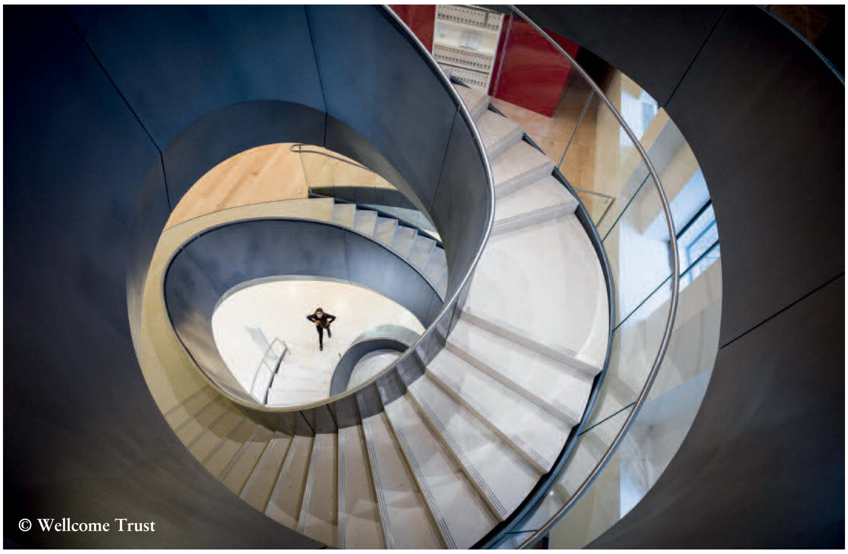
Satisfying the constraints and the client was a noteworthy success for large steelwork.

MERIT

Wellcome Collection Dynamic Stair, London

PROJECT TEAM

Architect:	WilkinsonEyre
Structural Engineer:	AKT II
Architectural Metalworker:	Clifford Chapman Staircases Ltd
Main Contractor:	Overbury
Client:	Wellcome Trust



© Wellcome Trust

© Wellcome Trust

The Dynamic Stair is a key feature of the Wellcome Collection's development project and the concept was to create a free-flowing form, travelling from floor to floor without any visually intrusive supports.

Building the stair within the confines of an existing building presented a series of constraints in terms of capacity and accessibility.

To install the stair the team was required to make significant alterations to the first and second floors, firstly introducing an opening to facilitate the stair's insertion and then to provide the supporting steelwork to carry the stair loading back to the historic primary structure. Access below ground floor was not possible and so the strengthening of this floor, or the vertical structure, would be impossible. Hence, it became clear that steel was the only realistic option for the stair, exploiting the strength and stiffness of this material and its readiness to be worked into complex forms.

For the stair itself, the chosen solution uses the inner balustrade and floor components as a structural monocoque that exploits every part of the stair as part of the structural system. This provides the vertical and torsional stiffness necessary to deliver the desired vibrational characteristics and architectural aesthetic in an efficient and lightweight manner.

Each of the 18 sections was made up of 8mm thick steel plates which were formed by a mixture of pressing or cold rolling and then welded together. The heaviest of the sections weighed 3.5 tonnes and was lifted in to position via a bespoke temporary structure and lifting strategy.

The aspiration for the finish of the stair was to exploit the natural steelwork as much as possible. The final solution was for the outside face to be shot blasted and sealed with clear lacquer. The inside faces were sprayed with a cold zinc and hot stainless steel solution. The inside surfaces were then hand polished.

The Dynamic Stair now provides the renovated Wellcome Collection with a strong central visual statement. The simplicity and tactile nature of the polished whirling form allows the crafted steel of the stair to be displayed and celebrated. The outer balustrade glass accentuates the movement of visitors around the staircase and up through the building, allowing visibility throughout the floors. Generous breakout spaces surrounding the stair give it room to breathe as a sculptural object in its own right.

JUDGES' COMMENT

This finely crafted staircase winds its way through two floors, with a changing geometry to fit the tight constraints of the existing floor structures. The combination of galvanizing and hot-applied stainless steel spray, which was hand-buffed, creates a most attractive finish.

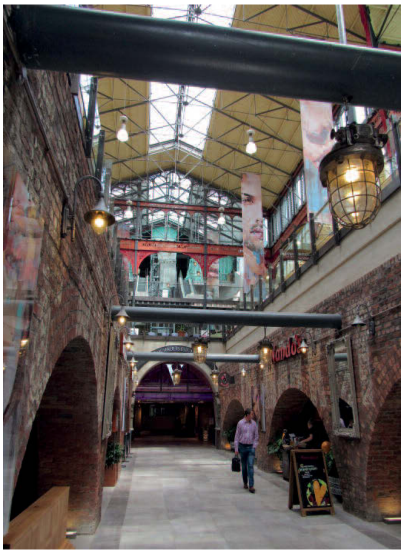
The merits of this finely crafted project have helped to enable visitor numbers to double.

MERIT

Market Place Shopping Centre Redevelopment, Bolton

PROJECT TEAM

Architect:	Wren Architecture and Design
Structural Engineer:	Ramboll
Steelwork Contractor:	Shipley Structures Ltd
Main Contractor:	McLaren Construction Ltd
Client:	Moorgarth Properties Ltd



The historic 'Market Place Shopping Centre' was originally constructed in 1851, utilising a cast iron framework with feature fretwork panels and dowel pinned lattice roof trusses. The redevelopment adds a nine-screen cinema complex extension on the roof of the existing building, and restructures the central feature atrium to provide further restaurants, bars and cafés in the underground 'Victorian' arched vaults.

A steel-framed solution was selected to maintain the slimline effect of the existing structure and minimise the weight of the cinema extension. Steel also suited the restrictive nature of the site, where the shopping centre had to remain fully operational throughout, in terms of the speed of erection and omission of temporary works.

The 250 tonne 30,000ft² steel-framed cinema extension adopted a beam and column arrangement with long-span rafters, internal clear heights of 10m and structurally independent internal seating support frames and maintenance walkways. S355 grade steel sections were used throughout and the new frame was spliced onto the existing building columns and floor structures.

Internal strengthening and remodelling of the existing four-storey steel framework was needed to carry the additional loading from the cinema extension and amended escalator runs. This included the installation of underslung stiffening beams to the existing floor members, and the incorporation of two new 16m long 762 x 267 UB battening beams to the underside of the existing floor at level 2, to facilitate the removal of the central section of a primary existing steel column in order to provide clear unrestricted access to Cinema Screens 1 to 4.

The restructuring of the central Atrium area included the provision of a fully welded 21m high exposed 'feature' steel lift shaft, infill link bridges and the creation of a new 14m x 10m opening in the ground floor slab.

A feature 'space-frame' roof structure at the head of the remodelled central Atrium, incorporating 'T' section top chords and a suspended circular tie rod bracing system, replicates the original roof detail on the adjacent cast iron framework.

Whilst a tower crane was available for approximately 60% of the upper roof extension with a working radius of 78m, the balance of the cinema above level 2 had to be installed using a series of spider cranes and Roust-A-Bout lifting frames.

All of the internal steel members for the strengthening and remodelling works between basement and second floor level had to be hoisted through service holes in the existing concrete slabs and 'hand-balled' into position.

JUDGES' COMMENT

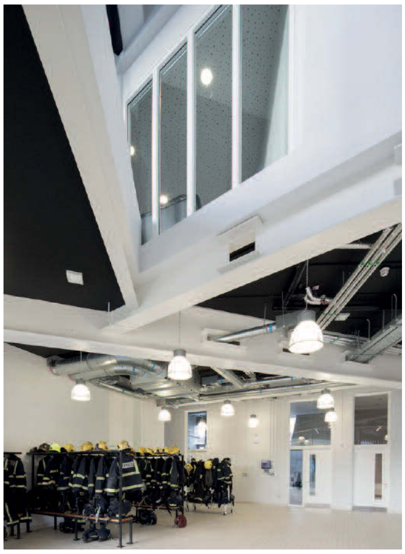
The new steelwork provides for the addition of a nine-screen cinema over a Grade II listed shopping centre. Construction was particularly demanding because the Centre was required to function throughout the contract period. The tower crane reached only 60% of the works, so many components had to be manhandled into position.

The tough logistical challenge was met in a meritorious way.

MERIT

Waterford Fire Station

PROJECT TEAM	
Architect:	McCullough Mulvin Architects
Structural Engineer:	O'Connor Sutton Cronin
Steelwork Contractor:	Steel & Roofing Systems
Main Contractor:	Duggan Brothers Contractors Ltd
Client:	Waterford City & County Council



Shaped around active service where function is paramount, the building form derives from tracking the movements of fire tenders leaving the appliance bays at speed and returning after firefighting. A strong form wrapped in zinc is folded - origami-like - to enclose a drill yard with different training zones.

Organised in a spiral, rising from single storey vehicle parking, workshops and dormitories to first floor offices, canteen, leisure and study facilities and terminating at a second floor lecture theatre, the zinc roof is angled and cut away to provide sheltered inside-outside spaces overlooking the yard, where the drill tower acts as urban beacon in a new public space.

The steel structure is supported on strip foundations and supports precast concrete planks which form the floor slab. The building is formed from inclined planes and folded volumes and the flexibility in design of the steelwork facilitated the complex geometries of the structure, while expediting following trades such as zinc, drywall, blockwork, mechanical and electrical services. This allowed a shorter and simpler build programme. Steel trusses are utilised to give long spans in the appliance bay to facilitate the appliances driving to and from the drill yard to outside active duty.

The building brings together many differing uses, requiring a variety of structural solutions to achieve the desired functionality for the client.

The large open-plan appliance bay, with sufficient space for 10 appliances, is achieved using long span steel trusses. Above this open space, a mixture of blockwork and steel provides the structure to the office area. A second wing, consisting of load bearing blockwork and precast hollowcore slabs, provides training facilities and living quarters over two storeys.

Both wings of the building, together with a covered car parking area to the rear, serve to enclose the large central training yard. The roof to all covered areas consists of a steel frame sloped to suit the profile of the roof. This steel frame supports a timber build-up underlying the finished sheeting.

JUDGES' COMMENT

The scheme is characterised by the architectural concept of a ribbon of accommodation wrapping around a courtyard in which emergency vehicles circulate and drills are carried out. The distinctive 'origami-folded' roof, formed from cranked steel beams, twists and rises over the different levels of accommodation.

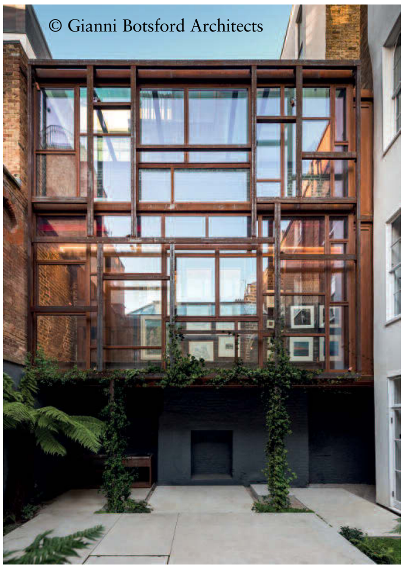
A most interesting addition to the town.

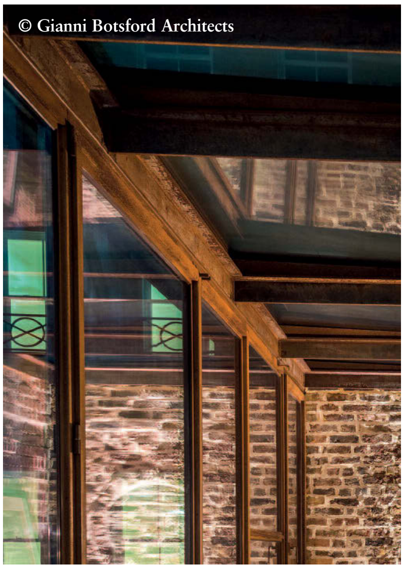
MERIT

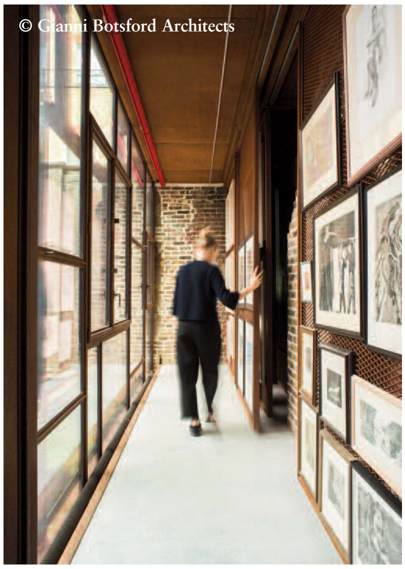
Layered Gallery, London

PROJECT TEAM

Architect:	Gianni Botsford Architects
Structural Engineer:	Entuitive
Steelwork Contractor:	Trescher Fabrications Ltd
Main Contractor:	Verona Construction







The Layered Gallery is an extension to a private residence, housing the owner's collection of photographs, prints, pastels and lithographs.

The design concept was based on a series of superimposed screens, creating a layered effect against a blank brick wall. The outermost 'layer' is a structural gridded screen made of weathering steel. The second is a weathering steel-framed glazed façade of museum quality UV-treated glass, which opens to allow natural ventilation. Inside the extension, two additional layers hang from each storey's ceiling: red blinds, which protect the collection of artworks, and the weathering steel display screens that showcase the collection.

The dendritic façade of the gallery is supported by the visible structural weathering steel frame on the building's exterior. Made from flat stiffened plates branching out over the three-storey structure, the entire frame is supported off just two 120mm x 12mm steel posts with a stiffening rib on the rear face, creating a T-shaped section. In a reversal of the usual structural hierarchy, this façade is also the main structural frame of the gallery, supporting all the floors and roof as well as providing lateral stability. Around 25 steel members make up the façade, each falling into a family of just three sizes: 120mm, 100mm and 70mm wide T-sections - all fabricated from flat weathering steel plate. At the upper storey, the steel members also wrap over the top of the extension and support the glazed ceiling, ensuring a coherent structural system and aesthetic for the entire extension.

Cranage at the site was impossible due to the constricted space and protected surroundings, so all structural components were sized to be carried into the courtyard through the house. The components that comprise the structural frame were precision fabricated offsite and erected within the courtyard as a kit-of-parts using only scaffolding.

Thoughtful connection design and careful detailing were key to the building's success. As the façade is the structural frame and, therefore, outside the building envelope, the floor beams, which connect to the façade, are detailed with a thermal break at the glazing line. Further, the numerous connections (45+) were each carefully coordinated to ensure ease of assembly between the members, and were detailed to conceal many of the bolts which are countersunk into the plate.

The Layered Gallery exploits the aesthetic and structural possibilities of weathering steel in nearly every detail, providing a space that blends the interior and exterior through its lightness of construction and its innovative structural solution.

JUDGES' COMMENT

This delightful filigree extension has completely transformed this historic house for its art-collector owner. Forming the backdrop to a new oasis of calm in a frenetic area of London, the building draws inspiration from organic forms of courtyard planting. Exposed weathering steel and external glazing systems are cleverly integrated.

This is a thoroughly contemporary take on a historic gallery and courtyard.

MERIT

Maxwell Centre, Cambridge

PROJECT TEAM

Architect:	BDP
Structural Engineer:	Ramboll
Steelwork Contractor:	The Wall Engineering Co Ltd
Main Contractor:	SDC
Client:	University of Cambridge Estate Management

The BREEAM 'Excellent' rated Maxwell Centre forms the latest development for The University of Cambridge. The new four-storey building contains research laboratories and offices complemented by seminar rooms, interactive spaces and dedicated hubs.

During the early stages of the project the design team investigated a number of different structural schemes. However, as the design developed, it became clear that a steel frame with precast planks was the only solution that could deliver the architectural aspirations within typical structural zones of just 350mm on 13m spans.

Steelwork was also the obvious choice to realise the architectural intent which features a doubly curved roof.

The 1200m^2 laboratories' area at lower ground level has no movement joints in the floor slab and just seven internal columns, allowing the laboratories to be easily changed in the future to cater for different configurations. The heavily serviced laboratory area benefits from a large bulkhead at the external perimeter allowing future flexibility for service installations. In addition, a generous allowance was included to suspend services from the precast plank soffit above.

The complex and challenging doubly curved roof was designed to reflect the curved roof of the adjacent Physics of Medicine Building. The roof was created using a series of curved steel beams, each with a slightly different radius.

The different uses of space between lower ground and the upper floors meant that there were many constraints on the structural layout. For example, to avoid columns disrupting the seminar room, the business lounge above is partly hung from the main roof beams. An 18m truss made up of open sections was used, suspended from three points in the roof. A truss concealed in a wall was utilised as the increased stiffness mobilised more mass and improved the vibration performance within the business lounge.

The centre of the building also boasts a three-storey central courtyard covered with an ETFE roof. Within this courtyard two meeting pods cantilever out within the space, as well as an open balcony suspended from the frame.

The exposed precast plank soffits are an important visual element and are also utilised for thermal mass in the naturally ventilated upper levels. The coordination of the steelwork support details was therefore of great importance, particularly at the column to soffit junction which included support plates for the planks, substantial torsional connections for the beams, and a connection for an inverted tee beam which acts as a frame tie.

JUDGES' COMMENT

Flexibility and efficient distribution of services were critical to this project. The solution was to use long-span floors supported on steel slimfloor beams, which also enabled natural ventilation. Four storeys are arranged under a doubly curved roof, reflecting the adjacent building to which it neatly links.

The result is an efficient and elegant building.

The Structural Steel Design Awards Scheme

2018 ENTRY FORM

The British Constructional Steelwork Association Ltd and Steel for Life have pleasure in inviting entries for the 2018 Structural Steel Design Awards Scheme.

The objective is to celebrate the excellence of the United Kingdom and the Republic of Ireland in the field of steel construction, particularly demonstrating its potential in terms of efficiency, cost-effectiveness, aesthetics and innovation.

OPERATION OF THE AWARDS

The Awards are open to steel-based structures situated in the United Kingdom or overseas that have been built by UK or Irish steelwork contractors. They must have been completed and be ready for occupation or use during the calendar years 2016-2017; previous entries are not eligible.

THE PANEL OF JUDGES

A panel of independent judges who are leading representatives of Architecture, Structural Engineering and Civil Engineering assess the entries.

The judging panel selects award winners after assessing all entries against the following key criteria:

Planning and Architecture

- Satisfaction of client's brief, particularly cost-effectiveness
- Environmental impact
- Architectural excellence
- Durability
- Adaptability for changing requirements through its life
- Efficiency of the use and provision of services
- Conservation of energy

Structural Engineering

- Benefits achieved by using steel construction
- Efficiency of design, fabrication and erection
- Skill and workmanship
- Integration of structure and services to meet architectural requirements
- Efficiency and effectiveness of fire and corrosion protection
- Innovation of design, build and manufacturing technique

SUBMISSION OF ENTRIES

Entries, exhibiting a predominant use of steel and satisfying the conditions above, may be submitted by any member of the design team using the appropriate form. The declaration of compliance with the award requirements must be completed by the entrant.

Entrants should ensure that all parties of the design team have been informed of the entry.

GENERAL

The structures entered must be made available for inspection by the judges if they so request. All entrants will be bound by the decision of the judges, whose discretion to make or withhold any award or awards is absolute. No discussion or correspondence regarding their decision will be entered into by the judges or by the sponsors. The decision of the sponsors in all matters relating to the Scheme is final.

A short list of projects will be announced and the project teams notified directly. The results of the Scheme will be announced in the autumn – no advance notification will be given to the project teams as to which structures will receive Awards.

Any party involved in a project that is no longer in business for whatever reason will not receive any recognition in the Structural Steel Design Awards.

AWARDS

Each firm of architects and structural engineers responsible for the design receive an award as do the steelwork contractor, main contractor and client.

PUBLICITY

The sponsors assume the right to publish the drawings, photographs, design information and descriptive matter submitted with the entry to publicise the award-winning structures in relation to the Structural Steel Design Awards Scheme.

FURTHER DETAILS

All correspondence regarding the submission of entries should be addressed to:

Gillian Mitchell MBE,
BCSA,
Unit 4 Hayfield Business Park,
Field Lane, Auckley,
Doncaster DN9 3FL

Tel: 020 7747 8121
Email: gillian.mitchell@steelconstruction.org

CLOSING DATE FOR ENTRIES - Friday 23rd February 2018

Sponsored by The British Constructional Steelwork Association Ltd and Steel for Life.

2018 ENTRY FORM

PLEASE COMPLETE ALL SECTIONS BELOW IN FULL (including email addresses):

Name of building/structure: ....

....

Location: ....

....

Programme of construction: ....

Completion date: ....

Total tonnage: ....

Approximate total cost (£): ....

Cost of steelwork (£): ....

DECLARATION OF ELIGIBILITY

As the representative of the organisation entering this structure in the Structural Steel Design Awards 2018, I declare that this steel-based structure has been fabricated by a UK or Irish steelwork contractor. It was completed during the calendar years 2016-2017. It has not been previously entered for this Awards Scheme.

Signed: .... Date: ....

On behalf of: ....

PERSON SUBMITTING THIS ENTRY

Name: ....

Tel: ....

Email: ....

SUBMISSION MATERIAL

The submission material which should be hard copies, should include:

- Completed entry form
- Description of the outstanding features of the structure (c 1,000 words), addressing the key criteria listed overleaf, together with the relevant cost data if available
- Architectural site plan
- Not more than six unmounted drawings (eg. plans, sections, elevations, isometrics) illustrating the essential features of significance in relation to the use of steel
- Six different unmounted colour photographs which should include both construction phase and finished images
- Memory stick containing the images submitted as digital JPEG files at 300dpi A5 size minimum and an electronic copy of description text in Word (not pdf format)

ARCHITECT

Company Name: ....

Address: ....

....

Contact: .... Tel: ....

Email: ....

STRUCTURAL ENGINEER RESPONSIBLE FOR DESIGN

Company Name: ....

Address: ....

....

Contact: .... Tel: ....

Email: ....

STEELWORK CONTRACTOR

Company Name: ....

Address: ....

....

Contact: .... Tel: ....

Email: ....

MAIN CONTRACTOR

Company Name: ....

Address: ....

....

Contact: .... Tel: ....

Email: ....

CLIENT

Company Name: ....

Address: ....

....

Contact: .... Tel: ....

Email: ....

Entry material should be posted to:
Gillian Mitchell MBE, BCSA, Unit 4 Hayfield Business Park, Field Lane, Auckley, Doncaster DN9 3FL to arrive by not later than 23rd Feb 2018

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