Structural Steel Design Awards 2015

Sponsored by: The British Constructional Steelwork Association Ltd and Tata Steel

SSDA 2015 SPONSORS

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INTRODUCTION

The 2015 Structural Steel Design Awards, Commendations and Merits, selected from a strong field of entries by the panel of judges, illustrate the high capability of steel to meet a wide range of construction requirements under a variety of environmental circumstances.

After giving awards for 47 years you might expect that a degree of repetition would occur amongst the winners. But not so, it has always been our claim that steel gives designers limitless opportunity for the expression of their ideas and the 2015 awards prove that this claim is fully justified.

In varying proportions, the qualities of engineering excellence, innovation, attention to detail, economy and speed of construction have been brought together in each of these successful structures.

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

M W Manning FREng CEng MIStructE MA(Cantab)
Representing the Institution of Structural Engineers

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W Taylor BA (Hons) DipArch MA RIBA FRSA
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O Tyler BA (Hons) DipArch RIBA
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OBJECTIVES OF THE SCHEME

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

AWARD

Moorgate Exchange, London

Project team

Architect:	HKR Architects
Structural Engineer:	Ramboll
Steelwork Contractor:	Severfield
Main Contractor:	Skanska UK Ltd
Client:	Blackrock

The brief was to provide a dynamic and high quality office and headquarters building, a modern architectural statement that maximised lettable area and provided efficient and flexible floor plates.

In order to achieve this, a steel frame was utilised to enable large column-free spans on a 15.5m by 7.5m structural grid. The structural floor zone itself was made the minimum depth possible to accommodate the required services openings, which allowed an additional floor to be introduced at the top of the building.

The building's west facing wedge-like form responds to the rights to light of the residents in the Barbican. Its height is limited by the St Paul's viewing corridor and the choice of structural strategy was influenced by the need to avoid conflicts with Crossrail tunnelling that partially overlaps the site's footprint.

The design team used these constraints to achieve a distinct architecture. The wedge has been creatively used to provide landscaped terraces at the upper levels. These are highly visible from the surrounding streets and notionally extend the greenery of the Barbican terraces eastwards.

The profile negotiates the step change in scale between the Barbican and Moor House to the east of the site. The double-height main entrance space on this corner creates a statement, providing maximum views from London Wall between Moor House and St Alphage, and creates a real sense of arrival through the use of a glass façade to the bright reception area and gently LED-illuminated glass fins that rise vertically across the full height of the building over the main entrance.

Internally, the large central atrium draws natural light into the adjacent office accommodation. A combination of high-specification glazing and external shading prevents overheating on sunny days. Energy-efficient LED light fittings, with daylight sensor control, will ensure that lights are switched off when adequate daylighting is available and the building fabric u-values and infiltration exceed Part L 2006 requirements.

Rainwater harvesting coupled with an onsite attenuation tank and a greywater recycling plant reduces stormwater run-off and mains water consumption.

By utilising steel rather than concrete, the building was able to achieve long column-free spans as well as reducing the overall floor zone, increasing the maximum number of storeys, and increasing the net lettable space for the client due to fewer and smaller columns.

The speed of construction for the frame was quicker compared to concrete frame options and, in addition, the lightweight superstructure frame allowed a raft foundation to be used. This would not have been possible with a concrete superstructure which would have needed a piled foundation solution, increasing construction time and cost.

The complex terrace transfer system also would not have been anywhere near as efficient without the use of steel, while the structure is also far more adaptable to future tenant changes than a concrete equivalent would be.

The steel frame was designed and rationalised to allow easier fabrication of the elements. This included using standard plate thicknesses which could be used to fabricate a number of different beams.

The steel frame was designed to be erected close behind the slip formed cores, which provided stability to the structure. Provision for a tower crane through the floor plates was included in the base floor design, and the design of the columns was closely coordinated with the steelwork contractor's preferred splice connections.

The steelwork contractor had a highly skilled set of workers onsite who erected the steel frame efficiently and on programme, with a minimal number of snags. The 'V' columns in particular required very tight control of site tolerances, and were delivered to site with the GRC cladding already installed to guarantee quality of finish.

Cellular beams were used to allow integration of the services within the structural zone, increasing floor-to-ceiling heights. The building itself was fully modelled in 3D from an early stage to maintain high levels of coordination throughout the project.

Concrete filled CHS columns were utilised to provide 90 minutes' fire protection without the need for any external fire protection on all of the internal and perimeter columns. This, coupled with a structural fire engineering analysis on the floor plates, allowed intumescent paint to be removed from a significant proportion of the steelwork.

Corrosion protection was provided through galvanized steel members in the externally exposed structure, helping the building to achieve a 50-year design life.

The building has fulfilled the client brief and achieved a BREEAM 'Excellent' rating.

Judges' comment

The team maximised the net lettable space by exploiting the great benefits of a steel frame - long clear spans with minimal fire-engineered columns, and with a reduced overall floor depth that enabled the incorporation of an additional storey. Level access to external balconies was a clever bonus. The lightweight superstructure permitted a raft foundation, impossible with other solutions.

A commercial success thanks to intelligent steelwork.

AWARD

First World War Galleries, Imperial War Museum, London

Project team

Architect:	**Foster + Partners**
Structural Engineer:	**BuroHappold Engineering**
Steelwork Contractor:	**Bourne Steel Ltd**
Main Contractor:	**Lend Lease**
Client:	**The Trustees of the Imperial War Museum**

The Imperial War Museum (IWM) was founded in 1917 and moved to the site in Lambeth on 7 July 1936. Since then it has been refurbished on numerous occasions over its history.

On 19 July 2014 – to mark the start of the Centenary of the First World War – a transformed IWM London re-opened with groundbreaking new First World War Galleries and a dramatic new atrium displaying iconic large objects and terraces featuring key stories from the museum collections.

Refurbishment of this heritage building uses structural steelwork once again to reinvigorate this British national museum. IWM London's atrium houses rockets, planes, tanks and other military hardware as a reminder of the weapons of war developed to protect the nation in times of conflict.

The refurbishment project required the cutting-out and removal of existing concrete floors and steelwork to create an extended atrium space for the large hanging exhibits. The removal of all materials and the introduction of new materials inside the enclosed atrium area was through the constraints of the existing entrance and access ways, and often material was manhandled when mechanical means was not possible. The access way into the main atrium was complicated by having a 90 degree turn from the access way between the existing concrete columns and the atrium space. This limited the new steelwork to a maximum length of approximately 8m. Trusses, stair frames, link bridges and long columns all had to be spliced to get them in the building, which also meant substantial temporary support frames were needed to erect the individual pieces.

To add to the challenges, the project commenced before the museum underwent a temporary closure period to allow for the most invasive works to be completed.

Therefore, removal of the existing hanging exhibits from the barrel vault roof and the survey of the existing structure had to be carried out simultaneously as night-time working.

Twenty tapered Vierendeel columns connect back to the existing steel frame, holding up a high level flying steel exhibition gallery including trusses and floor beams, above which sits the magnificent retained barrel vault steel roof structure. These new intricate column structures now support the fair-faced precast concrete cladding, as well as the hung exhibits, to complete a crisp structural elevation to the atrium space. Floating steel staircase structures, infill floor structures to match and extend the existing floors, a corridor structure in the existing loading bay and two new lift structures with a triangular truss link bridge to the high level flying gallery complete this 370t of new structural steelwork on the five storey internal structure, all of which had to match the existing floor levels.

The majority of the steelwork was finished with intumescent paint, with areas that are visible in the final condition being matched to the finish of the existing steelwork. The feature stair structure up to the link bridge was finished with a hot zinc spray sealed with a renaissance wax to the underside of the trusses and treads. The top of the treads were covered with a precast concrete nosing sat on the steel plates and the side trusses were finished with thin steel sheet wrapped tightly around the supporting steel members.

On the high level flying steel 'Roof Terrace', there were 12 specialist lifting lugs welded to the underside of the trusses and beams to support the aircraft hung from the flying gallery.

The erection of the high level flying steel required a load transfer operation to remove the existing columns supporting the barrel vault glazed end gable which was to be supported by the high level flying steel truss. The barrel vault glazing remained in place throughout the construction, so there could be no movement of the existing structure during the load transfer.

Due to the tight confines of the atrium area, the steel construction process had to be coordinated with numerous other trades to enable the final structure to come together.

HRH the Duke of Cambridge and the Prime Minister, David Cameron MP, officially opened the IWM London's new First World War Galleries following the refurbishment in July 2014.

Judges' comment

A dramatic new atrium has been built within the transformed museum. Angular and robust structures frame new galleries and support war machines in a cathedral-like space. Steel construction uniquely allowed constraints of access and time to be well-answered. The visitor route is now clear and exciting.

A strong sign of success is that visitor numbers have doubled in the year.

AWARD

Derby Arena

Project team

Architect:	FaulknerBrowns
Structural Engineer:	Arup
Steelwork Contractor:	Billington Structures Ltd
Main Contractor:	Bowmer & Kirkland
Client:	Derby City Council


All images courtesy of Bowmer & Kirkland

Derby's multi-sports Arena is a key legacy project that draws on sporting enthusiasm following the 2012 Olympics. The first new-build velodrome constructed in England since the London Olympics, the iconic 14,500m² building features a 250m Siberian timber Olympic-sized velodrome track.

In addition to the cycling facilities, the Arena allows provision for a large number of community sport and fitness activities, including a large fitness suite and aerobic studios. The main Arena space accommodates 12 badminton courts or three volleyball courts. The Arena has been designed for a range of sporting and non-sporting events and can hold up to 5,000 spectators.

Structural steelwork was used for the majority of the key elements of the project due to its strength allied to its relative lightness, aesthetic appeal and speed of erection. Steel was the ideal material for the large spans of up to 85m that were part of the design concept.

The innovative facility raises the track to allow greater flexibility of the infield for other uses, including court sports activity, events, exhibitions and concerts. The level access for day-to-day use and event logistics, rather than usual ramps and tunnels, makes this particularly attractive from an operational perspective.

The Arena building is diamond-shaped with chamfered corners. Its main entrance is on the western corner and the oval cycling track sits east-west across opposite diagonals of the building at the first floor level.

The geometry created between the curving roof profile and the lifting of the building front and back has been deliberate to create a consistent height to the upper façade. This consistency allows a horizontal strip cladding to be used akin to the boarding of the velodrome track. Whilst the height of the strips is consistent, the vertical jointing is random.

The cladding system is a metal long strip aluminium 'shingle' system. The 'shingle' system is a 'soft metal' rainscreen adopting the building curvature which tapers to create window 'eye-lids' and

integrated louvres. As a ‘soft metal’ system there will be a subtle and effective distortion and rippling appearance to the sheets which create a shimmering surface.

Three effective ‘eye-lids’ feature on the outside of the Arena building, which provided the challenge of accommodating twisted glazing with the frame. Due to the shape, this proved to be a complex element in the overall production, one which required optimum coordination between the steelwork contractor, glazier and architect to ensure a smooth and accurate execution.

Corrosion protection was achieved through combining offsite applied corrosion primer protection and onsite finishing coats, including intumescent paint as necessary.

Durable cladding systems to minimise materials consumption and waste generation were used to maintain a low environmental impact. Site materials were re-used in situ or sourced from a local supplier to minimise road transport to and from the site as far as possible. Sustainable urban drainage was used throughout the project to limit the impact of the new surface water drainage. Lined gravel filled trenches were used to provide conveyance and storage, and to keep excavations to a minimum within the landfill material. These were combined with large diameter storage pipes and a hydrobrake/surface water pump to control offsite surface water flows.

In terms of energy and carbon reduction, the strategy focussed primarily on the building fabric and achieving a well-insulated and airtight construction. In addition, the high efficiency central heating and hot water plant is supplemented with a combined heat and power (CHP) unit. It has achieved a BREEAM rating of ‘Very Good’.

By working together the design team was able to bring an innovative and futuristic design to life with an ambitious steel structure. With the selection of structural steel as the main construction material the building will stand the test of time, remaining aesthetically pleasing for generations to come.

The project was completed within budget and handed over earlier than the planned construction completion date.

Judges’ comment

A very well-executed project for a new velodrome that challenges the normal configuration by lifting the track to free-up the ground floor for a multi-use sports facility. The highly efficient steel-framed structure, with its 85m spans, exposes the steelwork where appropriate.

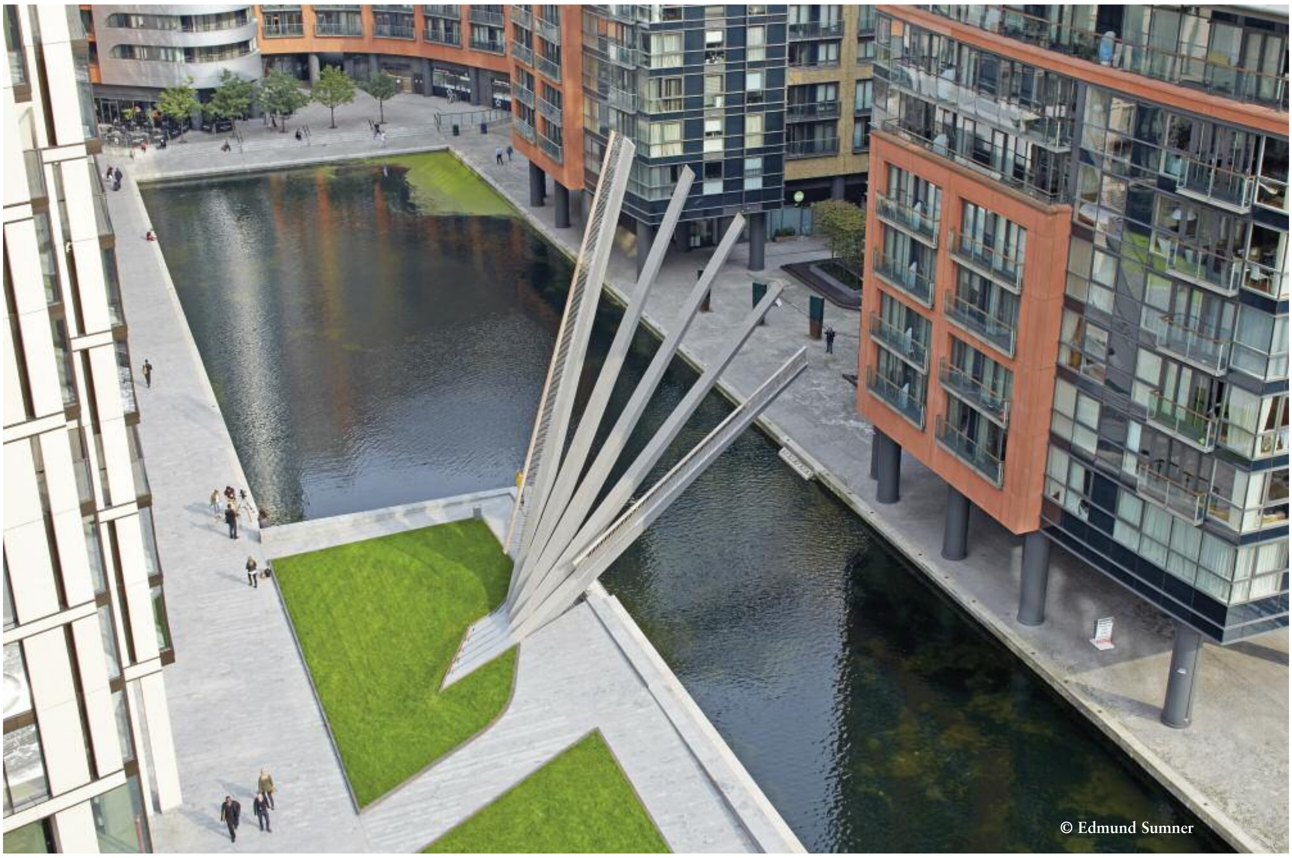
The building’s success owes much to careful integration of the architecture and engineering.

AWARD

Merchant Square Footbridge, London

Project team

Architect:	Knight Architects
Structural Engineer:	AKT II
Steelwork Contractor:	S H Structures Ltd
Main Contractor:	Mace Ltd
Client:	European Land & Property Ltd



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The new moving footbridge at Merchant Square in Paddington is a 3m wide cantilevered structure which spans 20m across the Grand Union Canal, and is divided into five slender 'fingers' which are raised using hydraulic jacks with an action similar to that of a traditional Japanese hand fan.

The fabricated steel beams forming the deck open in sequence, with the first rising to an angle of 70 degrees and the last achieving the required clearance over the canal of 2.5m tall by 5.5m wide at mid-channel. Shaped counterweights assist the hydraulic mechanism and reduce the energy required to move the structure. The bridge balustrades are formed from twin rows of inclined stainless steel rods overlapping to form a robust, yet filigree and highly transparent, structure. The handrail houses a continuous low energy LED downlight which provides excellent and uniform functional illumination of the walking surface and the edge, as well as offering an attractive lighting feature.

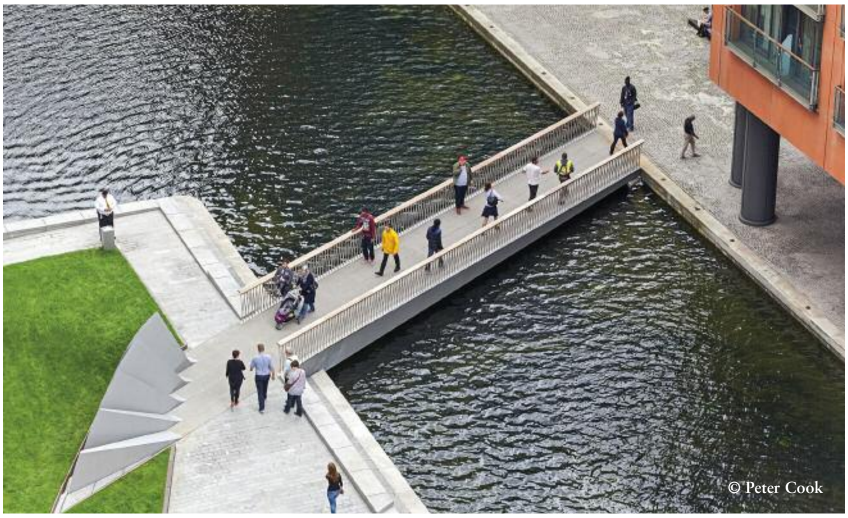
The relatively modest span suggested that only vertical movement would offer the drama sought in the brief. Constraints on land ownership dictated the bridge structure should be supported primarily from the north end, with only limited support provided on the south bank. Simplifying maintenance was a key driver - by dividing the beam into five discrete 'fingers' the duty on the hydraulics required to raise the beam is significantly reduced.

The design of the footbridge structure relied very much on the steelwork contractor's ability to manufacture the five 'fingers' to exacting tolerances. When in its lowered position the five slender steel 'fingers' had to effectively create a flat, almost seamless, walking surface. The five 'fingers' were set up in bespoke jigs which were used to control the critical dimensions and limit distortion caused by the welding process. Each 'finger' also had a sculptured blade at each end, which not only held the ballast needed to balance the bridge but also formed a vital component in the overall aesthetics of the bridge. Each blade tip was formed from profiled pressed plate which was carefully 'puddle' welded onto the internal stiffeners. The finished welds were ground flush to give a sharp seamless finish to the blades.

The fabricated steel beams received a high quality paint finish to provide a highly durable protective coating. The top surface of the beams is finished in a similarly durable epoxy and aggregate non-slip finish. The counterweights are formed from fabricated flat steel plates and the finish on the sculpted counterweights matches that of the beams.

Each of the five beams forming the bridge is activated with a small single-acting hydraulic cylinder driven from a single power pack located in the basement of the adjoining building. At around 6t and slender in shape each beam is a modest weight and experiences little windage, so the size of mechanism and power requirements are relatively low. The counterweights have been sized to aid the system while ensuring the bridge can always be closed under gravity.

The hydraulic cylinders and rotational bearings are housed in a concrete substructure beneath ground level, protected from the canal water by a drained sump and connected to the power pack by hydraulic pipework. Access to the hydraulic cylinders can be gained without closing the bridge to pedestrians and the bridge beams can be raised to provide

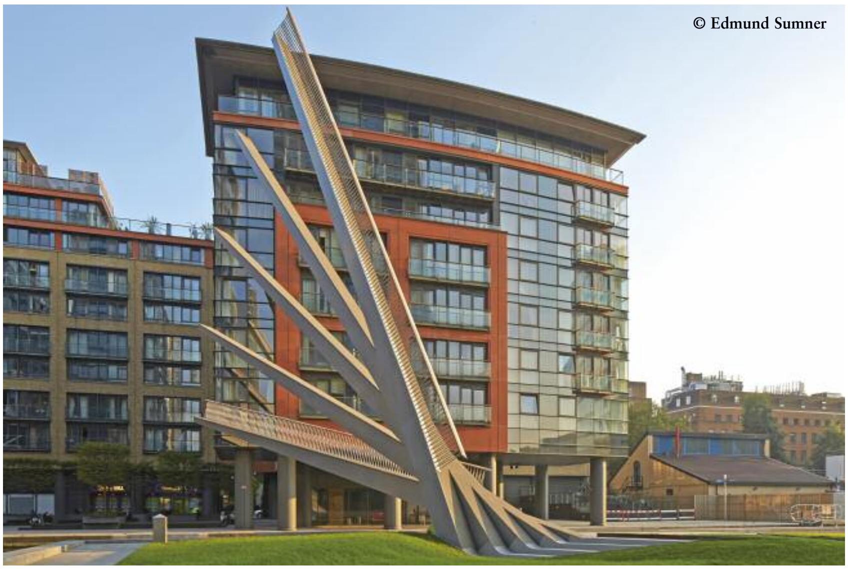


© Peter Cook

ready access for inspection, cleaning and maintenance.

Fabrication of the steel superstructure and mechanical, hydraulic and electrical components commenced early in 2014 and construction began with site clearance. The head of the canal basin was drained to allow access for other parts of the development and the bridgework took advantage of this for both the basement works and the installation of the beams themselves. Instead of delivering the structure direct to the site and lifting it into place with a mobile crane, the bridge 'fingers' had to be delivered to a wharf upstream to be offloaded onto a barge to be towed to the site with a canal tug. The built-up nature of the surrounding development and the ground conditions immediately next to the canal meant that the 'fingers' had to be lifted into place with a barge mounted hiab-type crane.

Bridges are a crucial element of the built environment at Merchant Square and, therefore, it was important for the new footbridge crossing the Grand Union Canal to enhance the public realm, not only practically but visually. This has been achieved by introducing vertical movement to the design to create a bridge that is highly visible and dramatic.



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Judges' comment

The new footbridge over Paddington Basin is formed of five 'fingers' which are each raised by hydraulic rams, and rotate about an axis on one side of the basin.

The erection of this novel structure was solved imaginatively by the contractor, as were the extreme requirements for accuracy.

This is in the tradition of exciting sculptural bridges in steelwork at this development.

Island Pavilion and Footbridge, Wormsley

Project team

Architect:	Robin Snell and Partners
Structural Engineer:	Momentum
Steelwork Contractor:	Sheetfabs (Nottm) Ltd
Main Contractor:	Mace Ltd
Client:	Wormsley Estate

Conceived in the English classical tradition of a pavilion in the landscape, the project re-interprets the 18th Century tradition for the 21st Century. The Island Pavilion, Wormsley House and Garsington Opera House form a landscape group of 'Pavilions in the Park'.

The Island Pavilion will be used for entertaining during the summer months of opera, including dining, receptions, art exhibition and musical recitals and has been designed as a container to house a stainless steel sculpture by Jeff Koons entitled 'Cracked Egg (Blue)'.

The single storey pavilion measures approximately 8m by 15m on plan and is 4m high, situated on the east side of the island. The structure is generally open plan, with cellular accommodation to the rear housing kitchen and washroom facilities. The primary space is a single room with glazed walls. None of the walls contribute to the structural system in order to allow the pavilion to be constructed quickly and easily onsite.

The pavilion is formed from three-pin portal frames at 3m centres, made from bespoke stainless steel sections for the rear and top elements. The columns supporting the frames at the front of the building are pin-ended stainless steel CHS posts. The frames sit on a galvanized steel structure set approximately 0.75m from the ground level. The floor construction consists of galvanized channel sections which support secondary steel members and a structural steel weldmesh floor upon which the architectural finishes are applied. The floor structure is connected to structural steel supports at the front and back of the building which also form the supports for the roof frames.

The roof of the pavilion is formed by a series of trusses which carry both the ceiling and roof covering. A profiled metal insulated decking is used to support the finishes and acts to create a diaphragm which carries elevational wind loads to the supporting elements of the stability system.

The structure is stabilised by the three-pin portal frames in the transverse direction. Longitudinally the vertical legs of the portal frames at the rear of the building are portalised together with a circular hollow steel member at the eaves.

© Dennis Gilbert

The foundations for the building consist of driven steel tube piles founded in the competent chalk at depth. These in turn support a grillage of reinforced concrete ground beams which carry the loads from the superstructure.

The pavilion was constructed using a series of prefabricated components which were delivered to the island on a barge. The key components were:

- 8m by 3m floor 'cassettes' consisting of galvanized steel perimeter channels, with secondary steel beam elements spanning in between at 1m centres. A steel grating is fixed to the tops of the secondary steels to form the support of the floor and provide racking strength to the 'cassettes' during the erection sequence.
- 3.5m by 10m portal frames - the bespoke stainless steel elements that make up the top and rear of the three-pin portals were fully welded offsite.
- 7.5m by 0.5m (max) secondary roof support frames.

The bridge is approximately 42m long by 2.1m wide with a series of intermediate supports to carry the bridge deck.

The bridge is formed by a single 355 by 16 CHS spanning between foundations at 10.5m intervals. Tapered 'I' beams are welded through the CHS at 2m centres to support the structural 'T' edge members. A profiled aluminium deck spans between the edge members, perpendicular to the span of the bridge. The deck cantilevers 300mm over the structural 'T' edge members. The CHS member carries both the vertical bending forces when the bridge is fully loaded and also the induced torsion when the deck is loaded on one side only.

The bridge is stabilised laterally by pairs of inclined CHS sections bolted down to the foundations.

The project took six months to complete and was a lesson in teamwork, integrated design and working directly with steelwork contractors, resulting in a crafted product utilising contemporary materials and technologies.

© Dennis Gilbert

Judges' comment

In rolling parkland set with architectural 'gems', this small pavilion and its access bridge are exquisite. The detailing and fabrication of the partly tapered, and partly stainless, plated steel members are exemplary. As the site was effectively in a swamp, the whole team worked hard to achieve timely results.

The project is a testament to the pursuit of technical refinement when economy is not key.

COMMENDATION

Heathrow Terminal 2B

Project team

Architect:	Grimshaw
Structural Engineer:	Mott MacDonald Ltd
Steelwork Contractor:	Severfield
Main Contractor:	Balfour Beatty Plc
Client:	Heathrow Airport Ltd

T2B is a satellite pier for the new Heathrow Terminal 2. The structure is rectilinear in form and accommodates 16 stands. A 520m long steel-framed superstructure sits above a two level basement.

By elevating arriving passengers over departing, the building offers a sense of space and inverts the familiar 'undercroft' experience of the arrivals journey.

The use of structural steel was essential to delivering the satellite pier to the client's programme. Using steel plunge columns allowed excavation of the basement by top-down construction while the pier's structural frame was erected above.

Among the first elements fabricated and installed onsite were the 163 plunge columns, assembled from the heaviest UC section and two 40mm thick steel plates, welded together to create a thick-walled box. The efficiency of this section and the novel 'top hat' connection – which transfers load from the concrete apron slab into the columns - allows unrestrained column lengths of up to 15m despite loading of 20MN.

Cold-formed steel sections were assembled into lightweight wall and ceiling panels to form the supporting structure for the arrivals corridor cladding.

The design team collaborated across disciplines using a 3D model environment, with the construction team extending this to produce 4D construction phasing and test access routes for mechanical plant modules. The 3D environment allowed virtual testing of exposed steel connection details ahead of fabrication.

To create a large, open space for the central hub, long-span cellular beams were used spanning onto the Vierendeel truss of the arrivals level bridge. This reduced the number of columns needed within the open area to just two, discretely positioned beneath the footbridge.

Architects and engineers worked together to develop a range of connection details and structural concepts that weave the steel frame into the architectural fabric. Suspending the internal glazed screens from roof level keeps the size and visual impact of supporting mullions to a minimum.

Prefabricating elements offsite ensured construction efficiency, minimised wasteful site-based construction activity and eliminated impacts on airport operations. The use of prefabrication, together with time-based 4D BIM, allowed virtual testing of safety issues, which could then be designed out.

By taking a fire engineering approach and limiting the fire load within the passenger concourses, it was possible to omit fire protection to the exposed steelwork.

The design embodies collaboration between architecture, engineering and construction to create an elegant expression of its lean design principles.

T2B is the first UK airport facility to achieve a BREEAM rating of 'Very Good'.

Judges' comment

A large and complex project, with severe demands (25% less cost and 10% less time than previously achieved) required the whole team to work exceptionally well and closely in order to satisfy a demanding and knowledgeable client. The varying degrees of complexity of the steelwork, and its architectural exposure, were very well planned, detailed and executed.

A success for steelwork in a challenging flagship project.

COMMENDATION

Milton Court, Guildhall School of Music & Drama

Project team

Architect:	RHWL Arts Team
Structural Engineer:	WSP Cantor Seinuk
Steelwork Contractor:	William Hare Ltd
Main Contractor:	Sir Robert McAlpine Ltd
Client:	Heron Land Developments

Milton Court is a new £89m facility built for the Guildhall School of Music & Drama. Located near the Barbican, it occupies two basement levels and the first six floors of the development. It includes a world-class 609-seat concert hall, two theatres, rehearsal rooms, office space, a TV studio suite, a lobby and bar, as well as an impressive roof garden.

The concert hall and studio theatre were designed to meet very high acoustic performance requirements utilising a 'box-in-box' principle. Due to the small footprint of the site, a steel 'box-in-box' system gave the benefit of acoustically isolating each internal part of the building from one another. Acoustic isolation was achieved by adopting an internal steel frame encased in concrete with walls constructed out of dense blockwork.

The studio also had a composite slab roof and an internal acoustically separated suspended floor slab. Every element of the structure was seated on isolation bearings.

The acoustically isolated suspended floor slab was constructed utilising Omnia units spanning between upturned steel 'T' sections, which in turn were seated on pre-levelled and grouted acoustic bearings. Once all of the units were in place, the whole area had to be completely sealed prior to concreting to prevent any grout leak and consequently a breach of the acoustic isolation.

Due to all columns being seated on bearings this necessitated considerable temporary works to stabilise each structure during construction. To compound the problem the steelwork contractor was not permitted to connect to the adjacent walls due to the high quality finish. Additionally, in the basement studio theatre, temporary connections were not permitted to the floor slab due to the risk of penetrating the waterproofing membrane.

A high quality, high resilience natural rubber was used for all the isolation bearings and they were locked into place during the construction. By isolating the steel structure the construction time increased as bolted connections had to be carefully designed and installed.

The construction of the main tower structure was well in advance of level 6 before the commencement of the steel erection. This meant that the internal steelwork to the studio theatre had to be erected within a closed concrete box. As a consequence, early coordination was required to ensure timely supply of lifting beams and lifting lugs to be cast into the theatre roof slab to facilitate erection of the structural steel.

The hall now has the largest audience capacity of any London conservatoire which makes it an ideal stage to showcase the talents of the school's musicians.

Judges' comment

A highly complex project on a dense urban site, with severe acoustic demands due to traffic noise and underground trains, and isolation between separate performance spaces. The solution is 'box-in-box' construction, whereby each performance space is constructed of steelwork built within, and isolated from, the concrete substructure.

Steelwork is key to this world-class music and drama facility.

COMMENDATION

Greenwich Reach Swing Bridge, London

Project team

Architect:	Moxon Architects
Structural Engineer:	Flint & Neill Ltd
Steelwork Contractor:	S H Structures Ltd
Main Contractor:	Raymond Brown Construction Ltd
Client:	Galliard Homes Ltd

Long planned as part of the development at Greenwich Reach, the bridge provides a valued link for residents to access public transport links and local attractions.

The bridge has a 44m cable stayed main span supported from a single mast with a central stay plane. A short 8m backspan contains a 120t counterweight to balance the structure. Two pairs of backstays support the tip of the mast laterally and longitudinally.

The structure is supported on a 3.7m diameter slewing ring bearing underneath the mast, with a set of four electric motors to drive the bridge clear of the navigation channel concealed in the machine room within the main concrete pier.

To swing the bridge across the channel, the drive motors rotate the bridge through 110 degrees. As it reaches the end of the swing, two stainless steel nose wheels engage with ramps on the west abutment to lift the nose upwards into its service position. An electrically actuated locking pin then engages to provide a nose restraint against extreme lateral loads.

Faceted planes create an elegant and visually massive backspan and reduce to a more slender main span with a central spine box supporting diagonal struts to the edge of the deck. The plated concept is continued through the main mast, where two vertical flat plates supported by diagonal stiffeners create an innovative open Vierendeel type structure. The inclined web plates create openings to the sky to lighten the appearance for maximum transparency.

Steel is crucial to ensuring that the moving span is as light as possible. By using externally painted weathering steel for closed sections, any requirement for internal inspection and maintenance has been removed.

Rolled ‘T’ section struts are used to support the edge of the deck, creating a thin edge beam and hence a slender appearance. The struts are inclined in plan and elevation to create a lightweight space truss to enhance the torsional stiffness of the deck supported by the central stay plane.

To minimise onsite welding and meet a tight construction programme, sections of the bridge were prefabricated offsite and brought to site by road. The structure was designed to facilitate easy fabrication, and the designers worked closely with the steelwork contractors to ensure an economic construction process.

The sections were craned into place in the open position before the backspan counterweights were installed and site welding completed.

The bridge provides an exciting link for pedestrians while still maintaining a thoroughfare for marine navigation.

Judges’ comment

Through simplicity of form and operation, and structural efficiency, this bridge is exemplary in its use and expression of plated steelwork. It has become a thriving route for cyclists and pedestrians, linking the new communities of Deptford Creek.

At the mouth of the Creek, this forms an effective and attractive feature of the maritime landscape of the Thames.

CERTIFICATE OF MERIT

Kew House, Richmond

Project team

Architect:	Piercy&Company
Structural Engineer:	Price & Myers
Steelwork Contractor:	Commercial Systems International
Main Contractor:	Tim & Jo Lucas
Client:	Tim & Jo Lucas


© Jack Hobhouse


© Piercy&Company

Set within the Kew Green conservation area of south-west London, this four bedroom family house is formed of two prefabricated weathering steel volumes inserted behind a retained 19th Century stable wall.

The site lies directly on the street and is oblong in plan, 18m wide and 10m deep. This small size and the surrounding brick walls between it and neighbouring gardens were key constraints in the development of the structural strategy for the house.

A key feature of the building is the weathering steel façades and roof. The house is split into two gabled forms which are joined by a glass link that houses the circulation – steel stairs, a link bridge between the two sides and a plywood slide down into the basement.

The roofs are made as structural stressed skin shells in 4mm weathering steel, strengthened with internal mild steel stiffeners. The roof shells form the watertight enclosure to the building, like an upturned hull of a boat. The shells have an intricate array of details, including perforations, expressed welded joints and concealed gutters and drainage channels around window openings, that retain their clean lines whilst making the shells functional as a building.

The shells were fabricated in 10 large modules offsite and shot blasted before being brought to site and lifted in using a lorry mounted crane. This approach allowed both the structure and roof finishes to be constructed from within the site boundary. The modules were site welded together to waterproof the joints before being lined with insulation, fitted with windows and drylining to give a total wall thickness of only 200mm.

The steel staircase forms a principal feature of the house in the glazed link. It is very slender, with a well thought out arrangement of stiffeners to give it the required strength to span 6.5m between the two sides of the house. After installation it was decided to leave it exposed rather than being covered in timber.

The engineer client took part in the building process by fully modelling the weathering steel shells in 3D, structurally designing them to an intense level of detail to include recessed built-in gutters, thermal breaks and windows flush with the outer face.

The prefabricated nature of the complex weathering steel shell meant that design challenges could be solved in the studio with architect and engineer collaborating on inventive and cost-efficient solutions.

Judges' comment

Through its use of weathering steel as the primary structural and visual material, and the ingenious use of the site, this private house can claim to enhance the conservation area. The prefabrication of the roof shells, a technique more familiar on large projects, is a powerful illustration of the potential of steelwork in domestic building.

This project merits attention for the potential of steelwork in domestic architecture.

CERTIFICATE OF MERIT

Weathering Steel House, Putney

Project team

Architect:	Eldridge London
Structural Engineer:	Elliott Wood
Steelwork Contractor:	Suffolk Welding
Main Contractor:	Famella


Photography by Lyndon Douglas © Famella


Photography by Lyndon Douglas © Famella

This project involved redevelopment of a garage building in south west London into a high-spec private house set out over four floors including a single basement. The rust-like appearance of the weathering steel cladding is a striking feature of the cutting-edge design of this private dwelling.

The house is in two distinct parts. At the front is the main four storey building, clad in weathering steel sheets interspersed with large glazed areas. At the rear is a separate single storey living space complete with glazed elevations and a green roof. The two areas are joined at ground floor level by a transparent corridor complete with a glazed roof, walls and floor sections; below ground the areas are also linked by a concrete basement which runs to the edge of the single storey living space.

The concept for the superstructure of the house was for it to be a monocoque, whereby the façade system also acted as the primary structure to the building. The finished material therefore needed to be sufficiently stiff to act structurally, as well as provide a weathertight enclosure and architectural interest. In addition to the architectural requirements, the constructional issues were significant. The footprint of the proposed house stretches between the boundary lines, leaving little working space for the contractor when onsite and required careful planning to construct a significantly challenging structure.

Steelwork was adopted as the primary structural material, with weathering steel as the external finish. This met the architectural requirements set out, as well as allowing the use of cladding as a stressed skin in combination with ribs, minimising requirements for additional primary structure to the perimeter. The use of a monocoque type structure was developed towards a series of prefabricated pods that could be erected onsite quickly and accurately. Connections were achieved by simply bolting the pods together onsite and then welding the weathering steel at its 'seams' to form a weatherproof envelope. To minimise heat loss, the connections between the panel and the internal floor structures were carefully detailed to prevent the junction creating a thermal bridge.

The prefabricated boxes were initially trial erected in the steelwork contractor's workshop, which gave the opportunity to begin structural glass procurement far earlier in the programme than would usually be possible. This greatly improved speed of construction of the structural elements.

Judges' comment

A house for a private client with individual demands, this elevates the use of structural weathering steel in domestic architecture to the level of bespoke tailoring. It illustrates what can be achieved by the closest attention to detail, and unified teamwork by architect, engineer and steelwork contractor/erector, as all details have been considered, coordinated and beautifully made.

Congratulations to the team for a meritorious labour of love.

NATIONAL FINALIST

St James's Gateway, London

Project team

Architect:	Eric Parry Architects
Structural Engineer:	Waterman Group
Steelwork Contractor:	William Hare Ltd
Main Contractor:	Lend Lease
Client:	The Crown Estate

The St James's Gateway redevelopment includes 57,000ft² office space, 28,000ft² retail space and 18,000ft² residential space.

The existing structure was replaced generally with a composite steel frame with normal weight concrete floor construction utilising composite metal decking. The grid varies with a maximum of 15m spans. This challenging, bespoke and innovative scheme involved digging out a two storey basement, installing 2,500m of closed-loop geothermal pipework, constructing a 1.2m-thick waterproof concrete raft foundation and erecting a braced steel core at the heart of the steel frame.

The Piccadilly façade embraced a steel Vierendeel frame construction to accommodate the large window frontage. As part of the development, the existing building at 27 Regent Street was refurbished; this included an architectural steelwork stair that was installed within the existing fire escape.

Judges' comment

Several diverse properties owned by the Crown Estate on a prominent site in Piccadilly, central London, have been given a new life as upmarket retail, office and residential accommodation. A pragmatic steel structure throughout has effectively enabled a sensitive restructuring, and combination of façade retention and invention.

The steelwork was key to meeting the complex programme.

NATIONAL FINALIST

Retail Development Plateau, Bargoed

Project team

Architect:	Holder Mathias Architects
Structural Engineer:	Capita Symonds Ltd
Steelwork Contractor:	Caunton Engineering Ltd
Main Contractor:	Simons Construction
Client:	Caerphilly Borough Council

The former South Wales mining town of Bargoed is in the midst of a £30m regeneration scheme, a programme that aims to revitalise the community.

Central to the overall plan is the rejuvenation of commerce and this will be achieved with a large scale retail development, based around a 5,200m² Morrisons supermarket constructed in the town centre. Known as the Retail Development Plateau, the 2.2 hectare site is situated on a 300m long by 20m high reinforced embankment.

Sitting on top of the plateau and abutting the retaining wall, the steel-framed retail development consists of a lower level undercroft car park for 400 vehicles, with the main Morrisons retail floor positioned above, along with second car park level. Above the main supermarket floor is a series of further decks, set back from the valley elevation, accommodating independent retail outlets and rooftop plant areas.

Judges' comment

This development successfully regenerates a site created by the use of old mining spoil, and links the town and the valley.

The steelwork is a conventional frame on a rectangular grid, including a horizontal truss spanning 80m to restrain a high retaining wall. The integration of geometrically complex heavily-loaded nodes into the other elements involved the whole team comprehensively adopting a Building Information Model approach.

A successful use of BIM in a steel project.

NATIONAL FINALIST

City Centre Bus Station, Stoke-on-Trent

© Jim Stephenson

Project team

Architect: Grimshaw

Structural Engineer: Arup

Main Contractor: Vinci Construction Ltd

Client: City of Stoke-on-Trent

Stoke Bus Station has a modern and inspirational design that reflects the character and landscape of the surrounding town.

The canopy of the station is an eye-catching and integral part of the design, protecting passengers from the elements, whilst facilitating wayfinding and creating a real sense of arrival and place.

The curved aluminium-clad roof wraps around the perimeter of the site to enclose a glazed pedestrian concourse providing a total of 22 bus stands.

The steel frame resolves what appears as complex geometry in an efficient manner. It is set out as a panoramic section utilising repetitive detailing. Maintaining a 5m clearance to the west, the steel frame expands and contracts as the concourse rises to the north. Details at junctions were designed to allow flexibility of the frame connection enabling ease of erection and simplifying manufacture.

Judges' comment

This carefully considered scheme will be a catalyst for future urban regeneration. Located on a major roundabout, its striking curved roof form is supported on steel 'V' columns, with a palette of materials including glass, aluminium, timber and steel.

This demonstrates how good design can lift the spirits.

NATIONAL FINALIST

Tottenham Hale Bus Station Canopies

Project team

Architect: Landolt + Brown Architects

Structural Engineer: Mott MacDonald

Steelwork Contractor: S H Structures Ltd

Main Contractor: Balfour Beatty

Client: Transport for London

The canopy design is based on a series of six steel 'trees', each comprising a central tapering trunk supporting six cantilevered branches. At canopy level, a triangulated perimeter beam runs between the tips of each branch to form the outer connection point for a series of tensile cables which radiate from the centre of each canopy to support a single foil ETFE roof. The use of these central columns and cantilevered beams minimises the number of ground level supports, freeing-up the ground plane beneath for the most efficient movement of pedestrians and buses.

The creative collaboration between the design team was key to the successful resolution of every detail, resulting in a design which is easy and inexpensive to maintain, is suitably robust with a steelwork design life of 60+ years, as well as being aesthetically sophisticated.

Judges' comment

Emerging from Tottenham Hale tube station, there is little doubt where the bus station is located as this imposing steel structure provides a beacon, as well as shelter for bus travellers. The structure is superbly fabricated and finished.

This steelwork is almost crafted to be a sculpture.

The Structural Steel Design Awards Scheme

2016 ENTRY FORM

The British Constructional Steelwork Association Ltd and Tata Steel have pleasure in inviting entries for the 2016 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 using steel predominantly sourced from Tata Steel. They must have been completed and be ready for occupation or use during the calendar years 2014-2015; 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, should be made under the categories listed below:

- Agricultural
- Leisure (including sports)
- Residential
- Traffic bridge
- Footbridge
- Other (sculptures etc)
- Commercial
- Industrial
- Retail
- Education
- Healthcare

Any member of the design team may submit an entry 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.

At the discretion of the judges there may be additional major awards given. These cover special or innovative features in a project.

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 Land, Auckley,
Doncaster DN9 3FL

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

CLOSING DATE FOR ENTRIES – Friday 26th February 2016

Sponsored by The British Constructional Steelwork Association Ltd and Tata Steel

BCSA

TATA STEEL

The Structural Steel Design Awards Scheme

2016 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 (£): ....

Category under which entry is made:

- ☐ Agricultural
- ☐ Commercial
- ☐ Industrial
- ☐ Retail
- ☐ Education
- ☐ Healthcare
- ☐ Leisure/sports
- ☐ Residential
- ☐ Traffic bridge
- ☐ Footbridge
- ☐ Other (sculptures etc)

DECLARATION OF ELIGIBILITY

As the representative of the organisation entering this structure in the Structural Steel Design Awards 2016, I declare that this steel based structure has been fabricated by a UK or Irish steelwork contractor and built using steel predominantly sourced from Tata Steel. It was completed during the calendar years 2014-2015. It has not been previously entered for this Awards Scheme.

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

On behalf of: ....

SUBMISSION MATERIAL

The submission material 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: ....

PERSON SUBMITTING THIS ENTRY

Name: ....

Tel: ....

Email: ....

Entry material should be sent to:
Gillian Mitchell MBE, BCSA, Unit 4 Hayfield Business Park, Field Land, Auckley, Doncaster DN9 3FL to arrive by not later than 26th Feb 2016

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