Structural Steel
DESIGN AWARDS 2007

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FOREWORD

From dramatic footbridges which lift the spirits, back to the Cold War and its grim memories – from an iconic theatre in London, to shimmering garden pavilion roofs in the North East – steelwork shows its astonishing versatility and effectiveness. This year's winners reflect success in satisfying the clients, whilst delighting the public who use the finished projects.

The judges have again been impressed by the skills and determination of the project teams, together with the clients whose vision has been vital. We have seen exciting submissions from around the UK, often reflecting regeneration of some of our towns and cities, benefiting from the care and attention these schemes have received. We have seen a strong field of bridges, ranging from large road/rail crossings to spectacular footbridges which can do so much to enhance their surroundings. The building projects have included an unusual London office block and an impressive museum structure which creates an ambience fitted to its gritty theme, and some "little gems" of small projects which are big in skills if not in scale.

The professionalism of the industry grows ever stronger, with highly motivated people exercising their skills in a constructive way to achieve noteworthy results.

The judges and the sponsors thank all those who made the submissions, and we look forward to even greater numbers and variety in future. We all gain benefits from the efforts which have achieved such success.

David W Lazenby CBE DIC CEng - Chairman of the Judging Panel

THE JUDGES

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Representing the Institution of Civil Engineers

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AWARD
NEWPORT CITY FOOTBRIDGE

ARCHITECT GRIMSHAW   LEAD DESIGNER & STRUCTURAL ENGINEER ATKINS
STEELWORK CONTRACTOR ROWECORD ENGINEERING LTD   MAIN CONTRACTOR ALFRED McALPINE
CLIENTS NEWPORT UNLIMITED AND WELSH ASSEMBLY GOVERNMENT

Newport Unlimited is an urban regeneration company established by Newport City Council and the Welsh Assembly Government. Its city centre master plan identified the need for improved pedestrian access to the town centre. The Newport City Footbridge plays a critical part in the city's accessibility strategy, linking the east and west banks of the River Usk and allowing people to travel quickly and safely between the two.

As the bridge was to be the first element of the master plan it was critical for it to be a landmark structure and to be delivered within published cost and time constraints. The bridge now acts as powerful evidence that the regeneration scheme is under way.

The bridge is located between two older road bridges, approximately 1km apart, immediately to the east of the commercial centre of Newport and is surrounded by future development sites. The River Usk flows into the Severn Estuary and has a large tidal range at this point.

The bridge's dramatic crane structure provides a symbolic link to the site's earlier use as trading wharves. Placing the main supports on the west bank also reflects the pronounced change in the urban scale and grain from the commercial heart of the city on the man-made west bank to the domestic uses and soft landscape on the east side

The deliberate concentration of major structures on the west bank has many practical advantages. The vast majority of temporary and permanent works were kept away from the nearby dwellings and river bank wildlife on the east side. Construction work was simplified, with no requirement for any works within the tidal riverbed and avoiding impact on the local river ecology. The existing car park on the west bank also provided an ideal construction site for final assembly of the structural components before installation.

At the competition stage the design allowed plenty of flexibility in the position and geometry of the bridge enabling in to easily be 'tuned' to suit final briefing requirements and site conditions.

The primary supporting structure is four masts, standing in pairs, which support the 145 metre long bridge deck from the west bank. The bridge deck loads are transferred to ground level by two 120mm diameter cables which also act as stays for the masts. The forward mast is 80 metres long and has a maximum diameter of two metres. The back mast is 70 metres long, but because of the angles at which the masts are positioned, the back mast is the tallest part of the structure, 67 metres above ground level. The deck is 5 metres wide and 4.1 metres above water at mean high tide level.

Fabrication of the 850 tonne structure began in August 2005 and pre-assembly work started on site in January 2006. Planning for the erection phase was complicated with numerous constraints in relation to site access, environmental impacts, stability issues and exceptional lift weights. Rowecord created a rapid lifting and construction sequence lasting a little over one week to build the bridge, utilising Britain's largest mobile crane - a 1,200t Gottwald AK 680 in conjunction with a 500Te capacity Liebherr telescopic crane.

Phase 1 of the erection scheme consisted of raising the back mast, placing it on its trunion support, rotating it backwards onto a temporary prop and connecting the rear anchorage cables. The front mast was then lifted and installed at 15° to the vertical. At this stage strand jacks connected to the temporary prop were attached to the front mast to allow release of the main erection crane. Following attachment of the forestay cables the front mast was lowered on the strand jacks to its final attitude at which point the forestays cables became taut and pulled the back mast forward thus releasing the load from the temporary prop and strand jack system.

Phase 2 consisted of the erection of the five deck sections and two pre-cast abutments. The centre section was lifted into position using the Gottwald crane on a revised boom length to achieve clearances over the front mast hairpin and cables. The centre of gravity of the second deck section required moving via the use of kentledge to remain within the erection radius of the main crane. The introduction of out of balance forces that would have occurred on release of this deck section was catered for by tying the bridge sections back to the east bank abutment anchorages. Erection of the third section restored natural equilibrium to the bridge.

Final closure of the bridge was achieved via erection of the first and fifth deck units and pre-cast abutments utilising the 500Te Liebherr on either side of the river.

In addition to the structural steel, the bridge includes nearly three kilometres of stainless steel wire. With a load bearing capacity to carry 2,000 people, the structure also includes 20t of integrated dampers to prevent vertical and lateral oscillation. The masts are constructed from rolled and welded sheet steel and 'fixed' in mountings with 450mm long stainless steel pins weighing 500kg each. With a design life of 120 years, the bridge should be standing for many years to come and, with maintenance and cable replacement all factored into the design, there is every confidence that its upkeep will be straightforward.

JUDGES' COMMENT

Drawing inspiration from the city's historic wharves, this crane-like structure supports a 145 metre span footbridge/cycleway across the River Usk, with a mast rising 67 metres.

Fabrication and erection were a demanding task for the team.

The result headlines steel in a big way, and provides a magnificent, iconic landmark in the heart of the regeneration area.

SPECIAL AWARD FOR COMPOSITE STEEL/TIMBER STRUCTURE
ALNWICK GARDEN PAVILION AND VISITOR CENTRE NORTHUMBERLAND

ARCHITECT HOPKINS ARCHITECTS STRUCTURAL ENGINEER BURO HAPPOLD LTD
STEELWORK CONTRACTOR S H STRUCTURES LTD MAIN CONTRACTOR SIR ROBERT McALPINE
CLIENT THE ALNWICK GARDEN

The construction of the Visitor Centre and Pavilion is part of the ongoing development of Alnwick Gardens – one of the largest visitor attractions in the North-East. These buildings were constructed to cater for the increasing numbers of visitors to the gardens, following the completion of the final stages of work that involved the "Poison Gardens" and the "Tree House".

The buildings are to be the modern equivalence of the conservatory that once occupied the site that forms the gateway to the gardens through an historically listed wall. As flexibility of the spaces was of key importance, the buildings were constructed as "buildings within buildings". The two main buildings have clear span roof structures supported on free standing columns, abutting these are two smaller structures housing the shops. These roofs provide a continuous enclosure to the building footprints, with glazed screen walls forming separation between spaces and pods being used for the service areas.
The main servicing requirements to the spaces were provided by basements beneath the two buildings thus leaving the above ground structures totally clear of any primary servicing.

The Pavilion and Visitor Centre are similar in structural design and share an innovative timber barrel-vaulted structure with a diagrid roof grillage supported on timber flitched columns. These buildings each measure about 60 x 16m on plan. The main difference between the two spaces is the treatment of the inflated roof foil cushions that varied in transparency, insulation and acoustic performance, reflecting the various functions of the spaces beneath.

The building design required very close co-ordination with the engineer, architect and steelwork contractor as the structural frame is fully exposed. Buro Happold worked closely with Hopkins Architects to achieve a structural solution which would support the foil roof and applied loads, yet maintain a slender diagrid roof framework and columns. This was achieved by tying the column capitals, which support the diagrid roof of solid larch beams, creating a cable truss that also provided intermediate support to the roof. The pre-stress in the cables was balanced to match the dead loads of the roof to optimise the member sizes and reduce the thrusts applied to the columns.

The use of steelwork within the diagrid shell enabled the stresses in the members to be controlled such that the sizes of the solid timber rafters were acceptable. A further example of integration of steel within the structure is the columns. Here the stability forces were resisted by cantilever bending of the columns, with the major axis being stiffened by a steel flitch plate.
This helped control the deflections of the roof, thus reducing the bending in the rafters, and hence controlling their size. This was crucial in reducing both the member sizes and rise of the arch to create the aesthetic form required by the architect, client and planners for such a sensitive site, the overall height of the building being controlled by protected views across the Capability Brown landscape and the height of the listed wall.

This roof was constructed and installed by a steelwork contractor - the value of the timber works was small in comparison to the total roof contract that utilised approximately 300 tons of steel. This was made up by the cast nodes, tie rods and struts, closure ladder beams and the elegant façade wind posts. All elements were fully exposed and great care was taken in detailing and fabrication to achieve the finished result. The design life for the frame is 100 years, and great attention was made to the detailing and corrosion protection to ensure this.

The early involvement of S H Structures was crucial in the development of the structure. The grillage was developed such that the eccentric angles and twists were taken out at the joints, to enable the beam elements to be straight members with identical bolt patterns at each end. This also ensured that all nodes were geometrically identical. Weldable steel casting were adopted for these elements onto which the additional cable lugs etc could be attached to adapt the standard nodes for the various locations.

S H Structures was also available to manage the design and fabrication of the complex interface details between buildings and with the façades; this was done using an X Steel CAD model from which the fabrication process could be directly implemented to achieve the high tolerance requirements of the grillage.
S H Structures was also responsible for the installation of the frames; this was done by pre-fabricating ladder sections and lifting them onto the free-standing columns avoiding the need for extensive scaffolding.

The use of a steelwork contractor experienced in the design, fabrication and installation of complex buildings was crucial in the project. This was further supported by the tender returns that show the cost effectiveness of using a steelwork contractor that helped save the roof from extensive VE. It is thought that this is the first time that a steelwork contractor has been responsible for the detailed design and construction of a timber roof; but this shows how the expertise of the steel industry can be adapted to various building types.

JUDGES' COMMENT

A delicate and sympathetic treatment of the large continuous roofscape, covering a variety of space uses in this hugely popular destination.

Steel is a crucial element in the diagrid shell roof areas, and the elegant columns. Finely shaped and detailed timber adds robustness and cosmetic appeal to the structure.

A fine example of a multi-material solution, which is highly effective and delights the eye of the visitor.

All images courtesy of Paul Tyagi

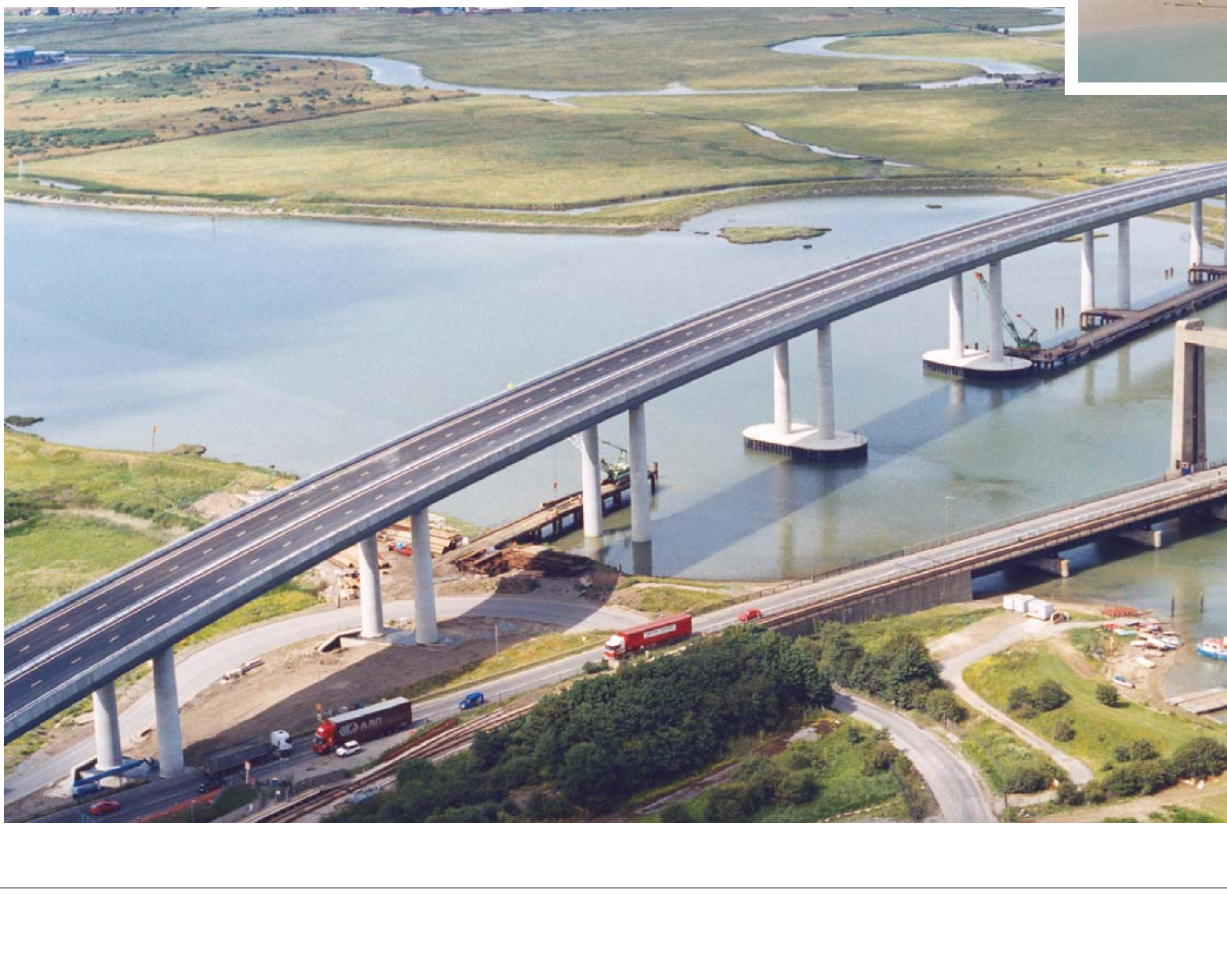


Image courtesy of Carillion

AWARD
SHEPPEY CROSSING ISLE OF SHEPPEY

ARCHITECT YEE ASSOCIATES LEAD DESIGNER CAPITA SYMONDS
VIADUCT STRUCTURAL ENGINEER CASS HAYWARD LLP STEELWORK CONTRACTOR FAIRFIELD-MABEY LTD
MAIN CONTRACTOR CARILLION CLIENTS HIGHWAYS AGENCY AND SHEPPEY ROUTE LTD

The completion of the new 'Sheppey Crossing' in 2006 has provided the first fixed link from mainland Kent to the Isle of Sheppey, a high level viaduct.
The viaduct was constructed as the primary feature of the Highways Agency DBFO Contract. The A249 dual carriageway now enables free flow of traffic. The bridge, which uses 10,000 tonnes of fabricated steel plate girders and 60,000 tonnes of structural concrete, is 1,270m long with 19 spans, the longest being 92.5m over the central navigation Channel of the Swale. The spans grow in length gradually from the abutments towards the main central span and the bridge depth increases proportionately to a maximum of nearly 4m at mid crossing. This unusual arrangement produces a most elegant elevation, which is enhanced by the sweeping curve of the highway rising to a crest of 30m above the estuary.

The bridge spans over the Saxon shoreway and due to the flat terrain there is a visual impact envelope of up to 30km. The flora and fauna in the area directly affected by the build were relocated to other parts of the marsh site.

The decision to launch the vast majority of the structure (15 spans in three phases using 14 separate launches) heavily influenced the design and also reduced the work load done by large capacity mobile cranes during the construction phase. The design programme mirrored the construction programme closely so that the release of deliverables allowed timely procurement and fabrication of the steelwork therefore avoiding congestion both in the works and at site.

The four main girders at 5.5m centres continuously varied in depth from approximately 1.5m at the abutments to 3.5m over the central navigation channel. 940mm deep cross girders at 3.5m longitudinal centres were fabricated in long lengths and then cut to the required length to suit Fairfield-Mabey's automated processes. Plan bracing to the central seven spans located between the two inner main girders ensured temporary stability during the launch and acceptable aerodynamic behaviour of the completed deck. The plan bracing was located at an aesthetically pleasing 300mm above the bottom flanges. Material grades used were S355J2+N (6 to 61mm) supplemented with S355 K2 (62 to 77mm) and NL (78 to 98mm) as necessary. Over 185,000 High Strength Friction Grip bolts were used in the structural connections, totalling approximately 100 tonnes in weight.

By using modern fabrication facilities and forging a team of the designers, main contractor and steelwork contractor, the high level bridge was fabricated and erected within programme and budget. Over 11,000 tonnes of permanent and temporary steelwork went into the construction of this landmark structure that was efficiently erected between December 2004 and December 2005, bringing substantial benefit to the local community.

JUDGES' COMMENT

The new road bridge replaces the previous road/rail lifting bridge, and provides much-needed improved access to the Isle of Sheppey.

For ship passage, the structure is some 30 metres high, but the team have achieved a solution which minimises intrusion into the flat landscape.
The main plate girders carry cross-beams within their depth, and they taper continuously from abutments to mid-span, both in plan and elevation.
The structure was launched from the north end, probably the longest of such operations. Having solved the primary challenges, the team have then refined the design to its successful conclusion.

JUDGES’ COMMENT

The new bridge provides strategic access to the Pacific Quay area, and is already a strong catalyst for redevelopment of this once derelict part of the city.

The single arch has a diamond-shaped profile, giving a slender appearance enhanced by reflections of light from the sky and the river surface, strikingly augmented at night by architectural illumination. The design of the arch, the hangers and deck, is satisfyingly and effectively resolved with clear expression of their functions.

This landmark structure is thoroughly professional, meets the aspirations of the client and is a major addition to the skyline of Glasgow.

AWARD
CLYDE ARC BRIDGE GLASGOW

ARCHITECT GILLESPIES ARCHITECTS STRUCTURAL ENGINEER HALCROW
STEELWORK CONTRACTOR WATSON STEEL STRUCTURES LTD MAIN CONTRACTOR EDMUND NUTTALL
CLIENTS GLASGOW CITY COUNCIL

This new landmark bridge, known as the 'Clyde Arc Bridge', crosses the River Clyde in Glasgow and significantly improves access to Pacific Quay Area and is a major catalyst in the redevelopment of this once derelict site.

The 96m span single arch rib and the hangers are a prominent yet complementary feature in the surrounding environment. The single arch rib straddling the deck is the first such structure in the UK to be tied to the deck. The diamond shaped arch section is also unique.

A condition that arose from the planning consent process was that the bridge should incorporate provision for a light rapid transit tram system in addition to the four lanes of traffic. This included increasing the surfacing on the bridge to 230mm to accommodate standard tram rails and the reconfiguration of the bridge articulation by moving the expansion joints from the abutments to the piers. These changes had fundamental implications for the design of the structure in that increasing the dead and live loading and reducing the relative stiffness of the deck significantly increased the load carried by the hangers and arch. However these changes were readily accommodated without changing the original design concept.

Minimising the environmental impact was a key factor in the development of the conceptual and detailed design.
This included the use of tubular piles and pre-cast concrete set above river bed level to minimise disturbing riverbed sediments. Maximising the use of off-site prefabrication in terms of steel and pre-cast concrete also minimised the duration of on-site works and significantly reduced the possibility of concrete spillage.

The solution offered in response to the client's brief is a bowstring arch with a single arch rib straddling the deck and inclined hangers connected to outriggers on the edge of the deck which creates interest for users of the bridge in terms of driving through the arch and hanger.
The single arch also clearly expresses the structural principles of the bridge and is not confused by a second arch rib or bracing members.

The diamond shaped arch rib is a unique feature of the bridge and significantly enhances the slenderness of the arch while also providing significant visual interest from the constantly changing reflection of sunlight and from the projection of the architectural lighting.

The structural relevance of the diamond shape is also demonstrated by the fact that in cross section the hangers intersect the arch rib at angles approaching 90 degrees. The arch springings are also a unique architectural feature of the structure with the transition from the steel diamond shape to a square concrete section which tapers out and when intersecting with the circular piers results in the interesting scallop features.
Other key architectural features include the two platforms that provide a vantage point for viewing the river and surrounding environment and the architectural lighting.

The arch is 130 metres long around the curve and was fabricated in sections each weighing approximately 50 tonnes. The fabrication was difficult due to the doubly curved nature of the side plates. A 3-dimensional model was used to produce the fabrication jig that was set up accurately on the shop floor using XYZ coordinates. The individual plates that had been accurately precut were fitted into the jig and the components tack welded together. The arch sections were then lifted out of the assembly jig with specially designed carrying and turning frames that allowed the sections to be rotated so that the longitudinal seam welds could be placed in a down hand position.

The construction of the abutments, piles, composite deck and steelwork were totally integrated resulting in efficiencies and cost savings. For example a large floating crane was required for the installation of the steel piles and the steel deck girders and pre-cast units were sized around the lifting capacity of this crane.

Four temporary trestles were installed in the river to support the deck during construction. Every lift was planned in detail and, in order to save hook time on the expensive floating crane, a hinged detail was developed so that all the splice plates could be fixed to the beams on the shore with a small crane and, once in position, the splice plates could be manually swung into place by the erectors. The steelwork erectors also placed the large full depth pre-cast concrete deck units using the same crane.

The nine arch pieces were delivered, assembled and welded on the deck into three large sections each weighing 150 tonnes. Two 500 tonne capacity cranes were then used to tandem lift the three sections onto the temporary trestles. The support trestles were then de-jacked and removed and the hangers installed. Finally the deck weight was transferred to the hangers and arch and the temporary supports in the river removed. The whole of the superstructure was completed between November 2005 and June 2006.

This impressive bridge meets all the client's aspirations and was completed to programme within budget. It is an excellent example of the benefits that early contractor involvement, associated with an integrated design team, can bring to a project.

COMMENDATION
ROYAL AIR FORCE MUSEUM COSFORD

ARCHITECT FEILDEN CLEGG BRADLEY ARCHITECTS STRUCTURAL ENGINEER MICHAEL BARCLAY PARTNERSHIP LLP
STEELWORK CONTRACTOR S H STRUCTURES LTD MAIN CONTRACTOR GALLIFORD TRY CONSTRUCTION
CLIENT ROYAL AIR FORCE MUSEUM

The brief called for a masterplan for the site as a whole that would include a modern museum building. The new building was to preserve the most precious aircraft and form the background to a display that would place the Cold War into the context of the times and be more accessible to the public. The museum was to include an auditorium, two classrooms and, later, a shop.

There had to be a balance between housing all the endangered aircraft under a simple cover giving only weather protection and, at the other extreme, protecting a small number within a fully controlled environment. The choice was for an insulated enclosure that gave the $7300m^2$ of exhibition space needed to house and reasonably protect all the military aircraft and a small number of civilian aeroplanes, together with the necessary ancillary accommodation.

The building's form is intended to represent a fractured space in response to this concept. A simple rectangle is slipped sideways along a diagonal "fault" line giving two opposed right angle triangles. The diagonal or hypotenuse is raised as a high level spine with opposing roofs sloping down to the longer external sides of the triangles. The spine is broken in the middle to provide a connection between the display areas on the two sides, which step up from low to high and reflect the sloping natural ground.

The lecture theatre, classrooms and ancillary spaces are accommodated below the higher floor.

The steel superstructure consists of a braced frame spine 25m high by 135m long, broken in the middle by a 75m "bridge". The spine supports a series of steel truss rafters 8.4m apart with slopes that vary progressively from 25^o at the gables to the vertical at the line where the roof meets the spine. Apart from its visual impact, the warped shape benefits the structural performance. The enhanced stiffness resulting from the interaction of the rafters through linking pieces allows a shallower structural depth and a significant saving in material.

The spine walls were designed to be self-supporting stable structures with the cladding in place. Having erected these walls the contractor elected to erect the rafters in a manner different from that which had been assumed. The sloping elbow pieces along the sides were erected first, the pinned bearing being temporarily fixed. Then the rafters were installed working in from the gable ends. The rafters, divided into up to three pieces, were lifted and supported in place by three mobile cranes, while erectors in cherry pickers completed the bolted flange plate connections.
All the components had been trial assembled in the works, erection was fast and accurate.

JUDGES' COMMENT

This striking building celebrates the end of 'the cold war', and its diagonally-split rectangular form reflects the schism between the super-powers in the second half of the 20^{th} Century.

The large space, some 25 metres high, has a hyperbolic paraboloid roof on a braced steel frame. V-bombers are suspended by steel cables from the roof, whilst other aircraft are parked below and film scenes heighten the effectiveness of the display. The mood is hard and uncompromising, with unpainted steel trussed rafters beneath the sweeping roof cladding, providing an effective and economic envelope.

The building presents a stunning spectacle on this windswept airfield, and provides an appropriate setting for an evocative experience.

COMMENDATION
BISHOP'S BRIDGE ROAD BRIDGE LONDON

STRUCTURAL ENGINEER CASS HAYWARD LLP
STEELWORK CONTRACTOR CLEVELAND BRIDGE UK LTD MAIN CONTRACTOR HOCHTIEF UK CONSTRUCTION LTD
CLIENT CITY OF WESTMINSTER

JUDGES' COMMENT

The team were faced with enormous challenges on this constrained and busy site. The successful project to widen Bishop's Road involved crossing a canal, London Underground and the mainline railway at Paddington.

The innovative lift-and-launch solution both to remove the old bridge and to install the new demanded planning, design and construction skills of the highest order, successfully minimising impact on the transport operations across the site.

The Paddington Bridge Project is part of a wider regeneration of the Paddington area. It originated from the introduction of the Heathrow Express Railway to Paddington Station, resulting in a parliamentary undertaking to improve the vehicular access to the station.

The main elements of the project are:

- Widening of Bishop's Bridge Road to 5/6 lanes between Eastbourne Terrace and Harrow Road. This entailed the demolition and reconstruction of the existing bridges over 14 Network Rail operated lines, the surface level Hammersmith and City Line, a former goods yard and the Grand Union Canal.
- Provision of a revised taxi access into Departures Road.
- Improvements to the junction of Westbourne Terrace and Bishop's Bridge Road.

The complexity and risk associated with the project necessitated a partnered approach to both the site works and the preliminary planning and development of the scheme. A design and build form of contract was utilised to allow the contractor's innovations to be applied to the demolition of old and erection of new bridge structures. The contract used was the NEC option C (Target Price).

This proved successful with teamwork, value engineering and responsible contractor selection resulting in the target price being beaten and savings being shared.

The project contained many risks, however the risk associated with disruption or damage to railway operations was the largest. Over the tracks from platforms 1 – 10 was an existing 1906 bowstring bridge. Over the other lines there were various structures including steel plate girder bridges supporting masonry jack arches.
The challenge was therefore to develop a scheme to remove the existing bridge and other structures and to install the new bridge structures that would ensure that the risks associated with working over the railway were minimised.

A number of methodologies were considered but the lift and launch scheme presented the most advantageous solution because critical path activities that had to take place over the railway, and hence the dependence on possessions, were minimised.
The fabrication of the railway bridge above the canal bridge meant that the need to carry out welding, bolting and concreting operations over the railway was eliminated.

The scheme developed had no reliance upon abnormal possessions, thus eliminating planned disruption to scheduled train services. Furthermore, the use of easily obtainable 'rules of the route' possessions reduced the risk of extended delays if the progress was not as anticipated.

By far, the most complex task was the launching of the new bridge through its 'second stage' to platform 1. The 2500 tonne bridge was launched forward over a series of 30 nights, to programme, reaching its final position within 8mm of its designed position. The methodology developed by Cleveland Bridge UK Ltd together with the teamwork and proactive approach to risk and overcoming difficulties has resulted in the project being delivered on programme, below target price and without any disruption to the rail services.

COMMENDATION
PALESTRA LONDON

ARCHITECT SMC ALSOP   STRUCTURAL ENGINEER BURO HAPPOLD LTD
STEELWORK CONTRACTOR WILLIAM HARE LTD   MAIN CONTRACTOR SKANSKA BUILDING
CLIENTS BLACKFRIARS INVESTMENT & ROYAL LONDON ASSET MANAGEMENT

Palestra is a state-of-the-art, 370,000 sq ft speculative office building comprising 12 floors and two basements, situated on the corner of Blackfriars Road and Union Street, Southwark.

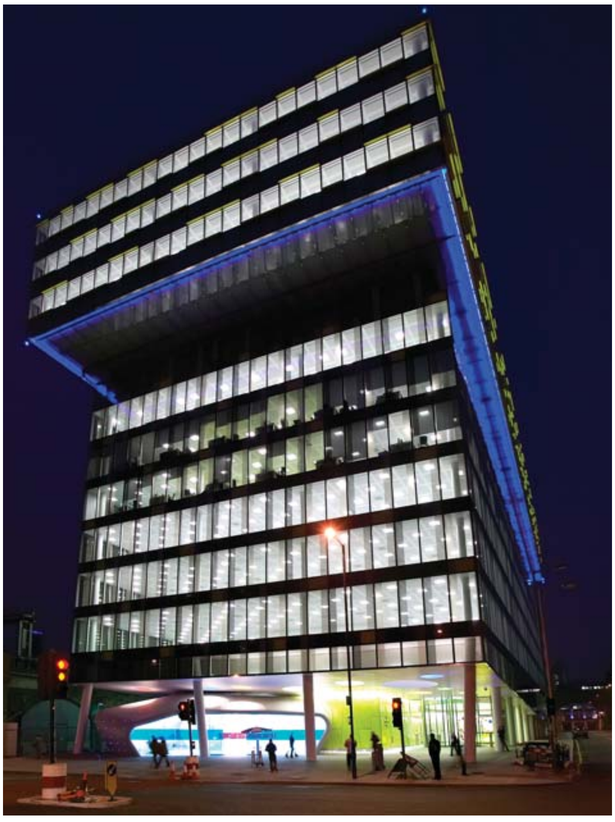
Ground level and above are formed with an innovative steel frame on a 12m x 87.5m grid, comprising of double beams and concrete filled columns, that offered all up steel weight for the typical levels – including columns of 58kg/sqm. However, what is of more architectural interest is the way the building is supported by "dancing columns" (inclined columns) at both the ground and 9th floor levels. Furthermore, on the Blackfriars Road frontage, the top three floors of the building cantilever out some 9m over the street pavement.

To accommodate the changing geometry imposed by the dancing columns and the various steps in the width of the building, whilst maintaining a total floor depth – including raised floor and lighting zone – of 900mm, an innovative solution combining double beams with composite columns was developed. The solution adopted not only simplified the installation of the building services by maximising the cells through the beams, but also maximised the efficiency of the beams by using them in double bending.

Twin cellular beams span 12m and are arranged in pairs that pass either side of internal columns and as such the beams' design takes advantage of continuity.
By utilising the sagging moment capacity of the beams past the columns, this yielded beams up to 35% lighter than otherwise would have been the case.
In effect each beam is acting as a single section across the width of the building with simple web plate shear, or pin splices located at the natural points of beam contraflexure. Similarly, the beams are simply connected to the columns via web plates that pass through the columns, thus ensuring that no moments are transferred into the columns.

The column construction consists of an external steel CHS filled with concrete grout with a further smaller diameter CHS placed at the centre. The design produces very high strength columns, enabling the structural engineer to provide a slim column carrying the high axial loads and an architecturally pleasing solution. The columns require no secondary fire protection even for the 120 minute fire period required.

At the west end of the building, the upper box is offset by one grid width from the lower, creating a three-storey deep 7.5m cantilever over Blackfriars Road.
This impressive feature was achieved without the introduction of any visible diagonal elements in the façade or any disturbance to the internal floor space.



JUDGES' COMMENT

This headquarters building, on a strategic site south of the Thames, exemplifies modern intelligent office space of today.

Within a challenging architectural concept, the engineers have rationalised the floor structures to minimise the depths by using twin floor beams, spanning continuously over two bays, with external cantilevers. Large floor plates have been achieved on a restricted site.

This innovative solution has successfully met the unusual demands of the building form, in a fine example of steelwork for commercial offices.

COMMENDATION
PONT KING MORGAN CARMARTHEN

STRUCTURAL ENGINEER GIFFORD   STEELWORK CONTRACTOR ROWECORD ENGINEERING LTD
MAIN CONTRACTOR CARILLION REGIONAL CIVIL ENGINEERING
CLIENT CARMARTHENSHIRE COUNTY COUNCIL

JUDGES' COMMENT

This slender and light-weight footbridge over the River Towy provides vital pedestrian access between the historic Quay and the railway station.

The twin-masted cable-stayed structure sits well in the landscape of the floodplain.

High quality and thoughtful detailing are the hallmarks of the bridge, which provides a landmark for the town.

Carmarthen County Council's new striking footbridge over the River Towy is a landmark structure fulfilling the client's sustainable transport needs for the local community and the region. The bridge has a clear span over the river with foundations wholly out of the river channel and back spans clear of flood levels therefore providing minimal impact on river habitats.

The form of the bridge design is a twin masted cable stayed structure supporting a fabricated steel cycle/footway deck which is curved in elevation and S-shaped in plan. The vertical masts are formed from shaped steel pylons which perforate the deck on its centerline. The deck widens locally at the pylon positions to provide viewing platforms for bridge users to take in the vistas of the town and river.
Lateral restraint to the pylons is provided by transverse stays, between the pylon tip and deck edge beams and is supplemented by tie-down stays connecting the deck to the reinforced concrete pylon supports immediately beneath the deck.

The S-shaped deck has spans of 28m over north car park, 78m over River Towy and 44m over flood relief channel, a total of 150m suspended. It has an effective skew over the river of 25º from bank to bank and is supported on cigar shaped steel pylons 20m in height via 14 pairs of stays - two pairs of which are high tensile steel bars providing lateral stability from the tips of the pylons to tie down stays connecting the deck edge beams to the concrete piers.

The eight deck sections and pylons were fabricated and fitted out with stainless steel parapets and anti skid surfacing at the factory. These items were delivered to site overnight due to their size (up to 21m long and 5.5m wide and ranging from 7T for the pylons and 11T to 29T for the deck sections) with widest sections around mast locations loaded on special type steel frames which were positioned structures at an angle to keep components within transport limits. The sections were lifted into place using 100T, 250T, 500T and 800T cranes, the larger cranes being used for the central deck section connecting the two arms of the bridge together. Deck sections over water were pre-fitted with access scaffold at joint connections prior to installation.
These sections were then aligned and temporarily bolted together using sacrificial cruciform brackets to facilitate welding of the permanent joints.
Final tensioning of the stays and plumbing of the pylons followed the welding operation.

All exposed steel deck and pylon surfaces received a 25 years to major maintenance paint protective system applied in the fabrication shop.
Welded site joints were 100% NDT examined on completion and the full protective paint system applied to these locations.

CERTIFICATE OF MERIT
THE YOUNG VIC THEATRE LONDON

ARCHITECT HAWORTH TOMPKINS LTD   STRUCTURAL ENGINEER JANE WERNICK ASSOCIATES
MAIN CONTRACTOR VERRY CONSTRUCTION   CLIENT THE YOUNG VIC THEATRE COMPANY

This project was the result of a competition to renovate or rebuild the Young Vic Theatre, which was originally built about 35 years ago as a temporary structure on a bomb site on the Cut, London SE1. The competition entry aimed to maintain the aura of the theatre, whilst significantly improving the quality of the spaces, the working conditions for the company, and the flexibility of the types of shows that could be put on.

This project was constructed to an extremely tight budget of £7million, and the outturn cost matched that budget. To achieve this, finishes were kept to an absolute minimum, which means that all the structure is expressed, and the detailing had to be carefully considered. Where fire protection is required, intumescent paint is used. Keeping parts of the original structure kept costs down, and is good for sustainability.

The general principle for the design of the auditorium structures has been to minimise additional vertical loads on the existing walls and their foundations, and to avoid alterations to the raft.

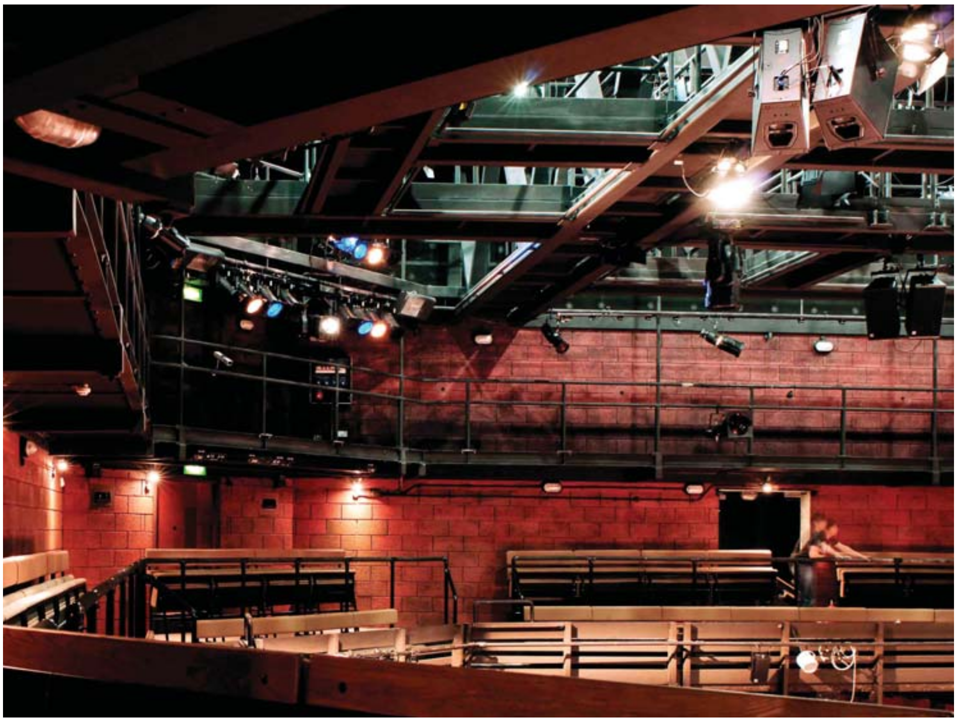
This roof is constructed using deep structural steel trusses which span from east to west. They are supported by a steel truss on the east side and steel columns on the west side. Steel beams span between the trusses and support metal decking with concrete topping, which provides the acoustic insulation. These beams also provide lifting points for the theatre.

The trusses support the 'egg crate' technical gallery that is constructed using structural steel. The new 'egg-crate' structure supports balustrading and lighting bars, and provides access to the lifting positions. Two central bridges are demountable and may be installed to run either north-south or east-west across the auditorium. The bridges are designed as steel ladder structures with lightweight timber floors. Vierendeel bracing provides lateral stability to the bridge structures.

A new technical gallery around the periphery of the auditorium is constructed using structural steel beams, with the inner edge hung from the roof structure and the outer edge supported on the existing wall.

The new front of house facilities in this area are generally constructed using a steel frame with timber joists and ply decking for the flooring and roof construction.

A structural steel portal frame is provided from level two to the roof for the back of house office facilities at the south of the site.



JUDGES’ COMMENT

This extremely complex and intricate re-build presented tough challenges to the whole team.

Steelwork frames much of the new building, including the new roofs, and particularly those above the theatrical spaces which are very flexible and adaptable. The cost constraints required ingenious solutions.

The Young Vic's traditional stimulating ambience has been maintained for the satisfaction of the lively audiences.

THE STRUCTURAL STEEL DESIGN AWARDS SCHEME
2008 ENTRY FORM

CORUS GROUP PLC AND THE BRITISH CONSTRUCTURAL STEELWORK ASSOCIATION LTD HAVE PLEASURE IN INVITING ENTRIES FOR THE 2008 STRUCTURAL STEEL DESIGN AWARDS SCHEME.

THE OBJECTIVE IS TO CELEBRATE THE EXCELLENCE OF THE UNITED KINGDOM 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 steelwork contractors using steel predominantly sourced from Corus.
They must have been completed and be ready for occupation or use during the calendar years 2006-2007; previous entries are not eligible.

THE PANEL OF JUDGES

A panel of independent judges who are leading representatives of Architecture, Structural Engineering, Civil Engineering and Clients, assess the entries. The panel includes members nominated by professional and government bodies.

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:

CATEGORY 1	Buildings of one or two storeys
CATEGORY 2	Buildings of over two storeys
CATEGORY 3	Bridgework : steel bridgework of all types including elevated highways, flyovers, viaducts, interchanges and footbridges
CATEGORY 4	Other structures : steel structures of other types, eg. offshore structures, underground works, tower-type structures

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 prior to the awards ceremony taking place and the project teams notified directly. The results of the Scheme will be announced in the summer at a presentation ceremony – no advance notification will be given to the project teams as to which structures will receive Awards, Commendations or Certificates of Merit.

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

The winners each receive a trophy, together with a certificate.
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, and may also include an industrial building award.

COMMENDATIONS

Structures commended by the judges, but not receiving an Award, will get a Certificate of Commendation.

MERITS

The judges may also award Certificates of Merit to other entrants at their discretion.

FURTHER DETAILS

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

Gillian Mitchell MBE, BCSA, 4 Whitehall Court,
Westminster, London SW1A 2ES

Tel: 020 7747 8121   Fax: 020 7976 1634
Email: gillian.mitchell@steelconstruction.org

ENTRY FORM
2008 STRUCTURAL STEEL DESIGN AWARDS

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: ....

Entry material should be sent to Gillian Mitchell MBE, BCSA, 4 Whitehall Court, Westminster, London SW1A 2ES to arrive by not later than Friday 7 December 2007.

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
- 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 (approx size 8” x 10”)
- CD containing the images submitted as digital file at 300dpi A5 size minimum and an electronic copy of description text

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.

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: ....

DECLARATION OF ELIGIBILITY

As the representative of the organisation entering this structure in the Structural Steel Design Awards 2008, I declare that this steel based structure has been fabricated by a UK steelwork contractor and built using steel predominantly sourced from Corus. It was completed and ready for occupation or use during the calendar years 2006-2007.
It has not been previously entered for this Awards Scheme.

SIGNED: .... DATE: ....

ON BEHALF OF: ....

Designed and Produced by
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