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MAY 2023
Vol 31 No 5

NSC

Cover Image
City Square House, Leeds
Main client: MRP
Architect: Todd Architects
Main contractor: McAleer & Rushe
Structural engineer: Ian Black Consulting
Steelwork contractor: Billington Structures
Steel tonnage: 1,600

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Steel scores excellently across the sectors

Nick Barrett - Editor

There must be very few investments made these days where sustainability isn't a central feature of the project's plans. It is hard to imagine a project where sustainability doesn't feature making its way into the pages of New Steel Construction; not because they would be banned, but because we just don't seem to come across any.

Clients of constructional steelwork have always benefitted from the widest range of sustainability advantages available from any construction material, often without realising the full value of what steelwork contractors were delivering. Today of course it would be difficult to raise funding for a project that didn't properly embrace sustainability - nobody in the construction supply chain wants to risk the reputational damage that would be associated with failing to take all practical steps to combat climate change.

The projects in this month's issue's news and features pages may be geographically diverse but they are linked by a common thread of facilitating sustainable development, and across a wide range of market sectors. They also qualify for a wide range of sustainability accreditations, from the various BREEAM levels, through EPC 'A' ratings for net zero carbon in operation, WELL certifications for providing work environments that promote wellness, and NABERS energy efficiency ratings.

In Stockport we can see how weathering steel provides a footbridge that is a key link for a fully integrated transport network supporting local councils and transport authorities in an ambitious regeneration scheme. Steel made this logistically challenging project 'look very easy', as you can read.

Steel is featuring on a major transport scheme in Belfast, known as Belfast Grand Central Station, that will be Ireland's biggest integrated transport facility. The steel-framed development will also promote sustainable travel and be crucial in shaping the future of the city as it forms the centrepiece of a new neighbourhood.

In Nottingham an industrial and logistics park comprising six steel-framed buildings that will all achieve BREEAM 'Very Good' ratings is regenerating a former tobacco factory site. The park's sustainability credentials, helped by the use of steel and by 98% of the old factory site's materials being recycled and reused, will be a key factor in attracting the high quality tenants the developers are targeting.

Sustainability increasingly isn't enough on its own to provide the office spaces that modern workforces expect, and we see the impact of a new focus on 'wellness' on an office development at Worship Square in London that aims at a WELL 'Platinum' Building Standard certification as well as BREEAM 'Outstanding'. Steel's flexibility comes into its own as developers aim to provide a range of collaborative and flexible workspaces and leisure facilities while reducing embodied carbon to less than half of current benchmarks.

Another office project aiming at high wellness qualities and a BREEAM 'Excellent' rating can be seen at City Square House in Leeds, benefitting from steel's unique ability to economically provide flexible, open-plan floorplates on what has been hailed locally as a world-class space.

This month in News we read about a net zero carbon in operation office building in Manchester that will aim at BREEAM 'Excellent' as a minimum, and will also aim at achieving a NABERS energy efficiency Design for Performance rating of 5.5 stars or better. Whatever the project's sustainability ambitions, steel seems to have the first choice solutions.

Planning granted for 32-storey City of London tower

A new tall building which promises to rejuvenate Leadenhall Market, create major new public spaces and showcase the City's 2,000-year history has been given the green light.

The City of London Corporation's Planning Applications Sub-Committee has approved plans for a 32-storey tower at 85 Gracechurch Street, creating over 27,000m² of new office space.

The plans, drawn up by architects Woods Bagot for developers the Hershten Group, will retain and restore the 1930s facade of the existing nine-storey building, with the new structure built behind.

The development will boast an imposing ground-floor public hall including food, retail and event spaces, reopening a historic pedestrian route between Gracechurch Street and Lime Street Passage and increasing footfall into the market.

It will also feature a fifth-floor heritage garden and free public exhibition celebrating the history of the site where once stood the Forum and Basilica, which was the heart of Roman London.

City of London Corporation Planning Applications Sub-Committee Chairman Shravan Joshi said: "Developments such as this are a vote of confidence in the City as a global business hub and will helps us meet the continued demand for high-quality office space in the Square Mile.

"This scheme sets a high bar for others to follow. It will create a major new public hall, a pedestrian route and a cultural space showcasing the rich history of this part of London, supporting our Destination City vision of the Square Mile as a seven-day-a-week visitor destination.

"We worked closely with Historic England to ensure preserving and showcasing the archaeology of the location."

Contractor appointed for First Street expansion

Property developer Ask Real Estate has announced the appointment of main contractor, BAM Construction, to deliver the next phase of office development at First Street in Manchester City Centre.

Pension Insurance Corporation (PIC), a specialist insurer of defined benefit pension funds, has invested £105M to forward fund the new 12,600m² steel-framed net zero carbon in operation office.

Plot 9a is being brought forward by lead developer, Ask and its JV partner, The Richardson Family. The building will have a BREEAM minimum rating of 'Excellent' and is also one of the first offices in Manchester capable of achieving a minimum NABERS Design for Performance rating of 5.5 stars or above - the highest level of environmental performance in use.

It was announced in August last year that the Government Property Agency (GPA) has taken a 25-year lease on the entire building, which will accommodate around 2,500 staff.

It is expected that £31M in economic benefits will be generated by the relocation from London to Manchester of over 700 civil service roles, which forms part of the Government's Places for Growth initiative.

Steelwork company opens its doors to graduates

Billington Structures and Shafton Steel Services (both part of Billington Holdings) welcomed a group of potential future engineers from Wates' graduate scheme for a guided tour of their manufacturing facilities.

The graduates were given the opportunity to learn about Billington Structures' production process for steel construction and were also able to see the steel processing and profiling services provided by Shafton Steel Services.

"It was a very informative presentation and factory visit and great to see our next generation absorbing the information.

"They are now more prepared to understand the process that Billingtons work through to get from tender to site, and how we as main contractors can influence how efficient that process can be in terms of time and money," said Wates Project Director Dan Miller.

"We received a great insight into how steel frames are designed and fabricated. It was a very educational day for all of us new to the construction industry and we gained useful knowledge that will benefit us on future projects with steel frames," said Wates site management graduate Charlene Sango.

Work starts on final phase at Redditch Gateway

Main contractor Winvic Construction has been appointed by developer Stoford to deliver two industrial warehouses, forming the second and final phase of development at Redditch Gateway.

Located close to Junction 3 of the M42, the scheme is targeting net zero carbon in operation for both buildings, as well as BREEAM 'Excellent' and EPC 'A' ratings.

Severfield is fabricating, supplying and erecting the steelwork for both industrial warehouses. One unit is 13,200m² with two-storey offices totalling 1,700m², and the second comprises 23,885m² of warehouse and 2,749m² of three-storey office space.

The earthworks programme, to create the development plateaus, has begun and will comprise 108,000m³ of cut and fill and the diversion of two courses of Blacksoil brook, which currently cross the site. The foundations will be installed from May and the eight-week steel frame erection programme commences in July.

Danny Nelson, Winvic's Head of Industrial, Distribution and Logistics,

said: "The latest approach to digital design is being employed on the Redditch Gateway scheme and it's facilitated faster and clearer insights and solutions across the design, materials, and construction programmes and sustainability. The team has already made some great progress in the past week preparing for the watercourse diversion and we look forward to handing over the two facilities in December 2023."

Green light for major Edinburgh mixed-use scheme

Proposals for a mixed-use development including a hotel and office space at 20 Haymarket Yards have received planning permission from the City of Edinburgh Council.

The ten-storey, 17,000m² office space and the nine-storey, 197-bedroom hotel will be designed by 7N Architects and is being developed by Stamford Property Holdings.

Planning permission granted demolition of the low-rise Elgin House office building and construction of the new complex, which is due to start in 2024.

Aiming to achieve a BREEAM 'Excellent' rating, the project will feature energy efficiencies such as insulated built fabric, air source heat pumps and solar panels.

Uri Goldberg, Principal Owner of Stamford Property Holdings, said: "Our development will regenerate and intensify a current brownfield site in Edinburgh city centre, meeting a significant demand for a new kind of workspace that is sustainable and enhances the wellbeing of occupiers, designed to be amongst the highest standards of ESG compliant developments coming forward."

Harwell Campus set to expand with new innovation centre

Main contractor Glencar has been appointed to build a new £150M Moderna Innovation and Technology Centre (MITC) at the Harwell Campus in Oxfordshire.

The MITC development will encompass a research, development and manufacturing facility, providing the UK public with access to cutting-edge mRNA vaccines for a wide range of respiratory diseases, pending regulatory assessment and license.

Eddie McGillycuddy, Glencar CEO, said: "Life science and pharmaceutical projects are complex, controlled environments that require significant design and engineering ability to ensure they are delivered correctly. We have expanded our specialist team within this space to push forward and make these facilities a cornerstone of our continued growth in the coming years."

Darius Hughes, UK General Manager at Moderna, said: "We are delighted to reach this important milestone with Harwell and our lab build partners, Merit and building contractors Glencar. We look forward to joining the Harwell Campus health tech cluster and contributing to the UK's science and innovation community through investments in R&D.

When constructed, our facility at Harwell will harness mRNA science to develop and deliver tailored, innovative vaccines to the UK public that address particular threats from respiratory viruses facing our population."

NEWS IN BRIEF

All **Lindapter** CE Marked products are now additionally UKCA Marked, ensuring continued compliance with both EU and UK Construction Products Regulations. The company said that the certification demonstrates its commitment to quality and transparency of product performance by increasing the number of independent accreditations.

Willmott Dixon has been appointed by Oxford Brookes University to deliver two new buildings on its Headington Hill campus, which will provide cutting-edge, sustainable spaces for students, staff, researchers, partners and the wider community. Procured using the Southern Construction Framework (SCF), the new buildings within a Grade II listed estate will house a new teaching block and faculty offices, alongside an engineering building, all designed to transform science, technology, engineering, mathematics (STEM) and creative activities on the campus.

Kier has announced that it has started work on delivering new, purpose-built teaching facilities to Katharine Lady Berkeley's School in Wotton-under-Edge, Gloucestershire - one of the oldest state schools in the country. The new three-storey block will include various teaching spaces and is designed to support the school's goal of being net zero carbon in operation. PV panels on the roof, enhanced insulation levels, ground-source and air-source heat pumps will help the school achieve its sustainability goals and reduce operating costs.

Stoford and Gladman are to deliver a new employment park as part of plans to revitalise Wellesbourne Mountford Airfield near Stratford-upon-Avon. The deal could release up to 140 acres of much-needed employment land along the M40 corridor.

PRESIDENT'S COLUMN

The draft version of the guide, *Fatigue design of crane supporting structures* has been issued for comment to the BCSA Process and Technical Committee. The steelwork industry was very lucky to be able to persuade Charles King to work on this document. Some of you will remember that Charles used to work for the SCI before moving to Canada, he was heavily involved in writing publications on portal frame design in the past. There was a feeling that the UK structural steelwork industry needed more guidance on fatigue design and when it became public knowledge that Charles was returning to the UK, the BCSA didn't waste any time in asking Charles to take the lead in drafting the document. This guide will help designers to understand the physics and then be able to navigate the relevant design codes. There is a lot of work to do still but I'm hoping a document will be issued in the next six months.

It was recently explained to me that the Eurocodes were never supposed to be design codes for the design of steelwork but were supposed to be the design rules for the academics to be able to design rules for the designers in the field. The approach as described makes sense. What should have happened partially in hindsight is that the steelwork designers at the "coal face" should have had a large summary document/book that encapsulated all the necessary salient points of the Eurocodes in one easily accessible and manageable document. This would have been very similar to the large design books that govern US design, with everything all in one place. Unfortunately, somewhere along the way everybody in the UK became distracted and we all had to purchase far too many design codes and UK National Annexes that would easily swamp the whole surface area of the largest of office space.

Unfortunately, it appears that Eurocode development has been hijacked by academic institutions that prefer the design process to be further complicated. Efficient steelwork design is important, but what we don't want is the process to be further complicated such that design is dominated with largely unnecessary Finite Element design and so forth which adds no real value compared to the complexity involved in obtaining a solution. Surely, the easier it is to design the product, the easier it is to specify the product and that needs to be the mantra of the BCSA in its efforts to help the structural steelwork industry. The BCSA has already recognised that they need to drive the development of the UK National Annexes which will govern the use of the new Eurocodes for the design of steel structures to ensure that they are usable. The BCSA is also acutely aware that the new Eurocodes will need updated design guides to help the practical designer to be able to navigate the changes in the Eurocodes. The structural steelwork industry must be thankful to the money invested by British Steel at the time of the introduction of the first Eurocodes when they bank-rolled the development of a number of very important design guides produced by the SCI. If steelwork is to maintain its dominant market share, these guides will all need updating such that structural engineers remain comfortable designing buildings in steel rather than other materials. Rest assured the BCSA is on the case.

Mark Denham
BCSA President

Oxford's Life and Mind Building tops out

A significant milestone has been reached in the £4bn partnership between the University of Oxford and Legal & General (L&G) with the topping out ceremony of the new Life and Mind Building.

This city-centre construction project is the first launched under the joint venture that led to the formation of Oxford University Development (OUD).

The Life and Mind Building will deliver circa 24,900m² of cutting-edge research, teaching and innovation space. It will house students, researchers and support staff from the department of Biology and Experimental Psychology, significantly improving the way these disciplines are delivered in Oxford.

The building is situated at the gateway to Oxford's Science Area and replaces the Tinbergen Building which closed in February 2017. Set across two wings, it features laboratory and office accommodation, with a central atrium and lower floor teaching centre. The design will provide maximal flexibility and foster new collaboration between the two departments.

Working on behalf of main contractor Wates, Bourne Steel has fabricated, supplied and erected the project's steelwork.

Planning consent granted for Avonmouth logistics scheme

A hybrid planning consent has been granted for the development of 185,000m² of new industrial, warehouse and logistics accommodation at Central Park in Avonmouth.

Vancouver-based real estate development and investment firm, Epta Development Corporation (EDC) purchased the site in December 2020 and has appointed Stoford as development partner to deliver the scheme.

The scheme will now be known as Axis Works, includes a 92,000m² building and three other units ranging in size from 25,300m² to 32,300m², all with integral CAT A office space and up to 23 MVA site power capacity.

The highly sustainable scheme is targeting a BREEAM 'Excellent' rating, an EPC 'A' rating and net zero carbon in construction.

Features will include PV-ready roofs, air source heat recovery heat pumps, highly efficient thermal envelope design, provision for 'green roof' bicycle shelters and EV ready charging, and the use of recyclable materials where possible. Occupiers will also benefit from on-site nature trails, outdoor gyms and breakout facilities.

The site has already been cleared of the former AstraZeneca works and Stoford is now lining up to start site raising and infrastructure works. The developer anticipates being able to commence construction in early 2024.

Work set to start on major Islington office refurb

McLaren Construction has been awarded the shell and core contract for the refurbishment of Angel Square in Islington by developer Tishman Speyer.

The project will transform 11,891m² of office space in three linked buildings to create one 27,220m² building containing affordable workspace, a replacement public house and a public café.

The works also include retaining 70% of the existing structure, infilling the central courtyard and the construction of two new floors with roof terraces.

A new glass reinforced concrete façade will replace the 1980s-built brick façade and will be inset with glazed terracotta. Electric plant will be used throughout, supplemented by renewable energy from rooftop photovoltaics.

Nacho O'Leary, Senior Director overseeing Tishman Speyer's Design & Construction activities across UK and Ireland, said: "McLaren has the experience of heavy refurbishment and of building above underground stations, which perfectly complements the rest of the project team.

"Together we will deliver a sustainable refurbishment which is a top priority for the firm."

Contractor appointed for Huntingdon business park

GMI Construction Group has been appointed by Trebor Developments to deliver a state-of-the-art business park in Huntingdon, Cambridgeshire worth £13M.

The company said the award, which represents a significant milestone as it expands its operations into new territories, will consist of two units with a combined area of more than 14,600m² to be constructed at Lightning Park.

Expected to be completed in 41 weeks, GMI will collaborate with UMC Architects and Ridge and Nolan Associates, with construction work on the site getting underway this Spring.

Logistics giant DHL UK have signed a long-term lease for the larger unit, while the smaller warehouse is to be built speculatively.

Located in a prominent commercial area just off the A1M and close to the newly improved A14, the BREEAM 'Very Good' development is approximately a mile away from Huntingdon town centre.

Greg Dalton, Development Director for Trebor said: "We're delighted to hit three major milestones for the delivery of this site in securing planning, appointing a contractor, and agreeing terms with a fantastic occupier.

"We've worked closely with the occupier and it's a testament to our delivery team to get to this stage against the backdrop of uncertainty throughout the second half of 2022, and we look forward to delivering the units in 2023."

Plans approved for Oxford Science Park expansion

Oxford City Council has approved plans for three new buildings on The Oxford Science Park (TOSP), totalling over 37,100m².

Designed by architects Scott Brownrigg, each building will provide headquarters – office and laboratory facilities – for leading science and technology companies.

TOSP is majority owned by Magdalen College, Oxford, and is at the heart of its strategy to support discovery, innovation and entrepreneurship.

According to Scott Brownrigg, the strong performance of the office and laboratory markets over the last six months highlights the potential of science and technology for the UK economy.

The new buildings on TOSP are part of long-term, ambitious development plans to help meet this demand through the creation of exemplary additional office and laboratory space over the next three years. This additional capacity will support the growth of existing occupiers, providing flexibility with their space requirements, and enable new companies to join the Park's unique community.

The scheme is due to start onsite in the summer, with the first stage due for completion in 2024.

Muse submits plans for Crewe logistics park

Developer Muse has submitted a planning application to Cheshire East Council to bring forward WestonM6 – a new 120,700m² highly-sustainable logistics and business park.

Located close to the M6 motorway, Muse said the scheme will supercharge growth and create thousands of new jobs.

The company added, the plans will include three high-quality industrial buildings totalling approximately 69,000m². As part of the wider regeneration, it will deliver a range of amenities for the community, including landscaped nature areas, a 3km active walking trail and a wildlife 'pocket' park.

Muse Projects Director Alan McBride, said: "At WestonM6, we've worked hard to design a sustainable place that complements the existing neighbourhood being created, unlocks vast areas of greenery, to promote a healthy lifestyle, but importantly attracts significant inward investment and meets the demand for new jobs in the town.

"As a business, we're committed to creating vibrant places that leave a long-lasting positive legacy to benefit communities and at WestonM6 we know we'll achieve just that and build a brighter future for all in Crewe."

Diary

For SCI events contact SCI Education, tel: 01344 636500 email: *education@steel-sci.com* web: *https://portal.steel-sci.com/trainingcalendar.html*

Tue 6 June 2023
Eurocode Load Combinations
Online
Eurocode load combinations can cause some confusion amongst building designers, so this webinar has been prepared to explain which combinations are appropriate, in which circumstances. In addition to the orthodox cases, the presentation will also cover: specific provisions for roofs; the partial factors appropriate for crane actions; the combination when assessing brittle fracture; the variable action reduction factors and when they may be used; and serviceability.

Wed 7 & Thu 8 June 2023
Wind Actions & Snow Loads
Online
This short course will cover the calculation of wind actions and snow loads in accordance with the Eurocodes and the UK National Annexes.
The presentation on wind actions will cover the recommended approach of considering quadrants around the site for hand calculations.
The significant differences compared to the previous BS will be discussed.
Each delegate will receive a PDF copy of the SCI Publication *Wind Actions to BS EN 1991-1-4* (P394)

Tue 13 & Thu 15 June 2023
Designing in Stainless Steel
Online
This course will equip engineers with the skills necessary to design structural stainless steel in accordance with current European design practice. Topics to be covered include: material and mechanical properties; recent case studies; designing members and connections; and fire resistance. The differences in properties and behaviour compared to carbon steel will be highlighted. Each delegate will be given a PDF copy of the SCI Publication *Design Manual for Structural Stainless Steel* (P413)

Purlins play vital role

Available in three section types, Z, C and M, light gauge steel purlins, rails and mezzanine sections are a ubiquitous component in a wide variety of structures where lightweight, high-strength structural support systems are essential.

Purlins are most often designed and manufactured to meet the specific needs of each individual project, with section type, depth, length and gauge being selected according to the project's requirements.

Getting it right

Design and specification are crucial to the process, not only in ensuring that the final structure meets the necessary performance standards but also in delivering value for the end client; over-specified and the project could cost more than is necessary. In the UK market of Great Britain (GB), comprising England, Scotland and Wales, the Construction Products Regulation (CPR) places legal obligations on manufacturers, distributors and importers of construction products used within the GB market to place the UKCA (UK Conformity Assessed) mark on their products where they are covered by a UK-designated standard.

The requirements of the CPR and UKCA marking apply to construction products used on a project irrespective of the design standard adopted for that project; for example, BS 5950 or BS EN 1993.

For fabricated structural steelwork, engineers, contractors and steelwork contractors should ensure that their specifications require only UKCA marked (or CE marked until 30 June 2025) products are used on their projects in GB.

Similar requirements apply in the EU (CE marking) and the UK market of Northern Ireland (CE and UKNI marking).

Execution

For any project, the required quality of fabrication, or Execution Class, must be specified according to the procedures set out in Annex C of BS EN 1993-1-1 and its associated UK National Annex. The Execution Class should be specified for:

- The works as a whole
- An individual component
- A detail of a component

The engineer is responsible for specifying the Execution Class for the structure (the works as a whole). If the Execution Class for components and details is different to that specified for the structure, the Execution Class for these should not be lower than that specified for the works as a whole and should be clearly identified in the execution specification.

For the majority of buildings constructed in the UK, EXC2 will be the appropriate requirement.

The engineer should always derive the Execution Class based on the design parameters appropriate to each project. The quality requirements to each Execution Class are listed in Table A3 of BS EN 1090-2 and can be reviewed by the engineer if desired.

As mentioned, there is a danger for solutions to be over-specified and incur unnecessary costs. For example, if a project has an Execution Class of EXC2 but the engineer requires full traceability (an EXC3 requirement) instead of the partial (or batch) traceability requirement of EXC2, rather than specifying EXC3 on the basis of achieving this single clause requirement, it is suggested that EXC2 is still specified but with the higher level of traceability added to the specification.

BS EN 1993-1-1 states that the selection of Execution Class should be based on the following three factors:

1. The required reliability
2. The type of structure, component or detail; and
3. The type of loading for which the structure, component or detail is designed.

Guidance on straightforward procedure for determining the Execution Class for buildings is freely available on www.steelconstruction.info.

Getting the numbers right

With mandatory requirements covered, the engineer/designer needs to consider a number of additional factors in determining the specification and number of purlins required for a given application. Depending on what the purlins are being used for (roofs, side rails, mezzanine floors, etc.), these might include snow drifting, tiled roof, steep slope and wind loading.

Most purlin manufacturers will offer assistance in the design process, but Metsec leads the market with its dedicated software package, MetSPEC. Freely available for download, the package incorporates both British Standards and Eurocodes as well as the full range of Metsec purlin sizes to ensure that the specification process is as easy as possible.

The company also offers a comprehensive library of standard connections and macros for use with the Tekla Structures 3D modelling software.

Combined with expert technical support, these software packages ensure that the purlin specification process is as smooth and painless as possible, saving the engineer/designer time and ensuring that the end client receives value for money. ■

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A 750t-capacity mobile crane lifts the bridge into position.

Bridge creates new transportation link

A weathering steel footbridge will provide a direct and safe link for both pedestrians and cyclists between Stockport's new bus interchange and the town's railway station.

Due to open in 2024, Stockport Interchange forms a core part of the Town Centre West regeneration district, a 130-acre site that will see new housing, leisure, workspace and amenities delivered alongside major transport and infrastructure improvements.

The new Interchange will act as a welcoming gateway into Stockport as it will have improved facilities for bus users and improved connectivity between the town centre, the Trans Pennine Trail and the railway station.

Once complete, the Interchange will be a key transport hub and part of the Bee Network – the vision for a fully-integrated transport network bringing together trams, buses, walking, cycling and eventually trains in Greater Manchester.

Construction of the new transport interchange has been underway since August 2021, and will include a two-acre 'podium park' on the roof of the building and 196 high-quality residential apartments.

Another key element of the scheme is a 40m-long footbridge connecting the Stockport Interchange development to the town's train station. The structure was recently lifted into place, marking a key step in the transformative scheme.

Andy Burnham, Mayor of Greater Manchester, says: "The installation of the new bridge above Daw Bank is a major feat of engineering and marks an exciting milestone in the ongoing development of Stockport Interchange.

"The bridge is a key link connecting the new interchange to the railway station and will significantly enhance how residents and visitors access the town centre, whether they are walking, wheeling or cycling.

Working on behalf of main contractor Willmott Dixon, SH Structures fabricated the 6m-wide footbridge from facetted weathering steel plate and delivered it to site in two pieces.

Placed on temporary works, the bridge sections were welded together onsite and then moved into place, in readiness for the lift, using SPMT's. The 90t bridge, complete with its deck, was then installed using a 750t-capacity mobile crane.

As the bridge's final position is surrounded by a number of existing buildings and narrow streets, Jonathan Skinkis, Senior Build Manager for Willmott Dixon described the bridge lift as: "A logistically challenging operation made to look very easy."

According to the project design team, steelwork was chosen for the footbridge as the material offered the most efficient method to form a shallow structure that would not be too intrusive, within its surroundings.

"Detailed analysis was carried out into the dynamic behaviour of the bridge to ensure the design is safe, as well as achieving the desired architectural design intent," explains OPS Engineer Simon Ho.

"Weathering steel was used in the design as the material develops a warm orange-brown industrial feel, which will help the bridge blend with the many nearby redbrick buildings."

The Harris Partnership Associate Paul Stafford, adds: "The bridge spans diagonally across a four-way junction and will forge a new pedestrian and cyclist connection.

"Weathering steel is durable and malleable, and has allowed us to achieve a striking piece of geometry that complements the modern aesthetic of the new interchange and is an elegant addition to an area of historical heritage.

"And, importantly, the weathered nature of

Watch a video of this project on the newsteelconstruction.com website.

FACT FILE
Stockport Interchange footbridge
Main client: **Transport for Greater Manchester, Greater Manchester Combined Authority & Stockport Council**
Architect: **The Harris Partnership**
Main contractor: **Willmott Dixon**
Structural engineer: **OPS Structural Engineering**
Steelwork contractor: **SH Structures**
Steel tonnage: **90t**

The elegantly-designed bridge spans over a four-way junction.

The use of weathering steel will allow the new bridge to develop a similar hue to the adjacent railway viaduct.

"Weathering steel was used in the design as the material develops a warm orange-brown industrial feel, which will help the bridge blend with the many nearby redbrick buildings."

the steelwork reduces the life cycle maintenance strategy for the client."

While, increasing the longevity of the structure, weathering steel also has the advantage of reducing operational carbon emissions over a comparable painted steel structure.

Once the scheme is open, the bridge will merge into a 195m-long cycling and walking path with two seated rest areas along the route, providing a seamless and dedicated link for users to walk, wheel or cycle.

The route will be open 24 hours, with lighting and CCTV providing additional security and reassurance to passengers using the connection between the two transport hubs.

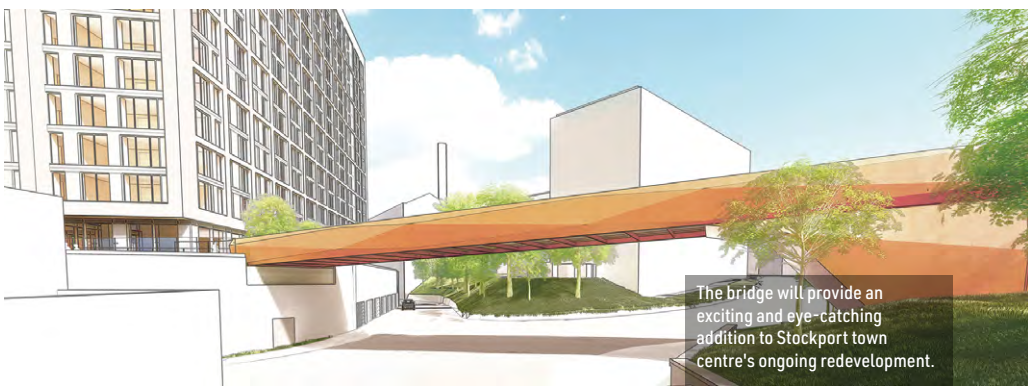
Cllr Mark Hunter, Leader of Stockport Council, adds: "The new bridge will ensure everyone can travel from Stockport Exchange and the train station to the Interchange, on to our brand-new two-acre Podium Park and then onwards to the town centre in a car-free environment.

"It's an incredibly exciting time for Stockport and I'm really looking forward to more milestones taking place at the Interchange development in the coming months."

Summing up, Lord Bob Kerslake, Chairman of the Stockport Mayoral Development Corporation (MDC), said: "Over the recent months, we have seen huge progress made across the regeneration sites in Stockport. In just a matter of weeks, we have announced a contractor partner to deliver the historic and sensitive Weir Mill redevelopment into a new mixed-use district, and launched a new eight-acre neighbourhood to market.

"The Stockport MDC, in partnership with organisations such as Transport for Greater Manchester, is delivering rapid, ambitious change for Stockport with a focus on creating one of the most sustainable, connected and liveable town centres in Greater Manchester." ■

The bridge was fabricated by SH Structures in two pieces, that were welded together onsite.



The bridge will provide an exciting and eye-catching addition to Stockport town centre's ongoing redevelopment.

Station to station

A series of long-span steel trusses form the distinctive saw-tooth roof of Belfast Grand Central Station, while simultaneously creating the large open space for the hub's concourse.

Big transportation changes are afoot in Northern Ireland, as a new combined rail and bus station is under construction in Belfast.

Known as Belfast Grand Central Station, it will on completion be Ireland's largest integrated transport facility and will also form the centrepiece for a new city neighbourhood.

With eight rail platforms and 26 bus stands, it will be the city's transport gateway, with connections to all parts of Northern Ireland and beyond.

Located on an eight-hectare site adjacent to the existing Great Victoria Street railway station and Europa bus station, which it will replace, the project is a catalyst for the regeneration of the area. It will ensure the right infrastructure is in place to encourage more people to make public transport their first choice for travel.

Drawing inspiration from Belfast's industrial heritage, part of the steel-framed station is topped with an impressive saw-tooth roof, that incorporates a series of north lights, allowing plenty of natural light to enter the building.

The feature roof, which spans the facility's main concourse, is formed with six 4m-deep trusses, which vary in length from 32m-long up to 65m-long, as the public area splays outwards on plan. The trusses then support a series of cellular beams that span 22m and support the roof and ceiling.

For ease of transportation, steelwork contractor Walter Watson has fabricated the trusses in sections, with the longest truss requiring five individual pieces.

With minimal columns, the longest internal span is 27m. There are four columns supporting the longest truss, while the shortest has two columns. All of these supporting members were erected sequentially along with the multiple truss sections.

"The roof structure is a signature element of the scheme," explains Farrans/Sacyr JV Project Manager David Bolton. "However, prior to steelwork commencing, we had a comprehensive preparatory and groundworks programme to complete that included CFA piling reaching depths up to 26m and construction of reinforced concrete shear walls."

Work started onsite in December 2021 and this first phase of the scheme is due to complete in late 2024. Once the new facility is open and operational, the Farrans/Sacyr JV will then begin phase two (see box).

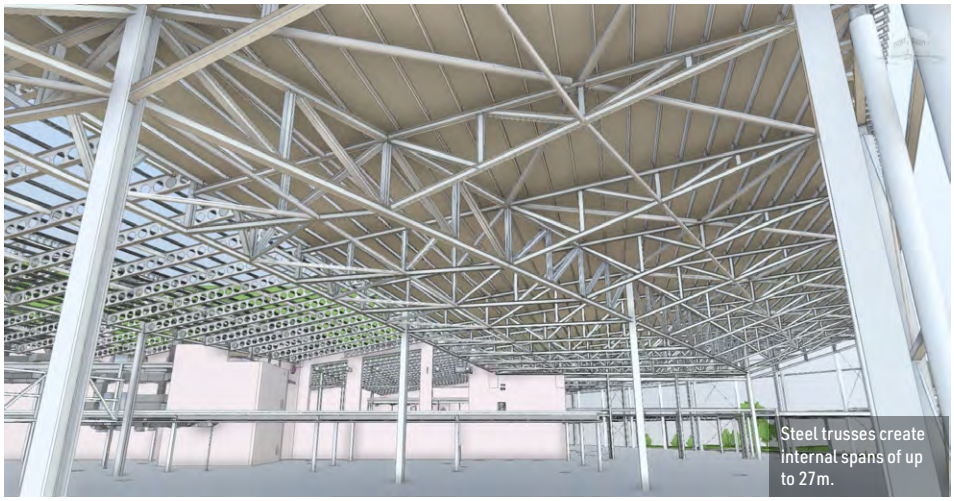
As well as internal columns, the saw-tooth roof trusses are supported on one side by a large stability-giving shear wall that separates the concourse from the railway lines, and feature perimeter columns on the other side.

"These columns are CHS sections, chosen because they will remain in view within the completed scheme, alongside the fully-exposed roof trusses," says Doran Consulting Technical Director Roger Knipe.

The building's main façades are fully glazed and will also feature cross bracing located between the CHS columns that works in conjunction with the shear wall to provide overall structural stability to the building.

Within the concourse, the steel frame also forms a two-level mezzanine that runs adjacent to the shear wall. Compositely-formed with steel beams supporting metal decking and a concrete topping, the ground floor will accommodate ticket booths and retail units, the first floor will have more retail units and offices, while the uppermost level will be a plant deck.

The front of the station protrudes beyond the centrally-positioned shear wall and tapers inwards to



Steel trusses create internal spans of up to 27m.

The new station will have 26 bus stands, with much of the forecourt opening later as it sits on existing infrastructure.

Phase two works

Once Belfast Grand Central Station has opened, work will then commence on phase two, which includes the demolition of the existing railway structures.

This work, which is due to complete by early Autumn 2025, will provide the space for the new bus terminal forecourt (only part of the forecourt will open in late 2024) and a new public realm to be known as Saltwater Place.

The landscaped realm will provide a focal point at the front of the new station. It will also form a centrepiece for the larger Weavers Cross Development – named in honour of the area's former linen industry - that will evolve on the site of the old rail and bus stations. ■

FACT FILE
Belfast Grand Central Station
Main client: **Translink**
Architect: **RPP Architects**
Main contractor: **Farrans/Sacyr JV**
Structural engineer: **Doran Consulting**
Steelwork contractor: **Walter Watson**
Steel tonnage: **2,400t**

form, what is described as, an arrowhead. One side is a continuation of the main concourse, while the other is another open-plan public area leading to the eight railway platforms.

This adjacent large public area is again formed with long-span trusses, although this side of the structure's roof has louvres, instead of glazing which is positioned within the vertical elements of the saw-tooth roof.

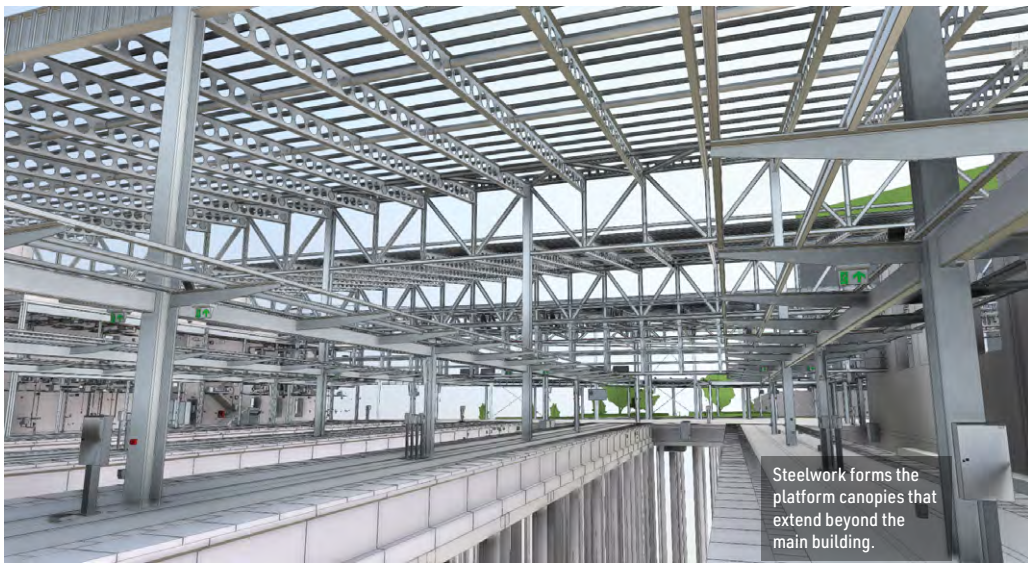
Creating a column-free zone above the platform entrances is a 65m-long x 4.8m-deep truss, that is only supported at either end and will itself support a walkway, signage and the railway station's information gantry.

The installation of this truss will be one of the final pieces of the overall steel erection programme and will only be completed once the adjacent spine truss, which has a central supporting column, has been installed.

An erection sequence involving three mobile cranes will ensure the truss is installed. Arriving onsite in five 13m-long sections, the first three pieces (A, B, and C) will be individually lifted into place by the three cranes and bolted together, while A will also be connected to a perimeter column. One crane will then hold the three connected sections, while the other two cranes will lift pieces D and E into place, allowing the final connections to be made.

Once the main steel frame has been completed, Walter Watson will install a further steel package to create the platform canopies.

The eight platforms will have four canopies with a combined overall length of approximately 750m. Platforms 5 to 8 are longer than platforms 1 to 4 in order to accommodate the Enterprise (Dublin) train, but all of the canopies will be formed with a series of UC columns supporting box section spine beams and T-section outriggers.



Steelwork forms the platform canopies that extend beyond the main building.

Summing up, Farrans/Sacyr Project Director Duane McCreadie says: "Belfast Grand Central Station will cater for around 20 million passenger journeys each year and will be crucial in shaping the future of the city and promoting sustainable transport." ■

The completed scheme will be Ireland's largest integrated transport facility.

Steel lights up former tobacco site

Power Park will deliver more than 39,000m² of industrial and logistics space in six steel-framed buildings on the former Imperial Tobacco site near Nottingham.

Cigarette manufacturing once played a significant role in Nottingham's economy, employing thousands of people who laboured to produce the once-iconic Players brand.

Due in part to changing habits and attitudes towards smoking, the final cigarette rolled off the production line in 2016, when Imperial Tobacco closed its large Horizon factory. This brought an end to over 130 years of cigarette manufacturing in the East Midlands city.

The 48-acre Horizon factory site, which has a strategic location, being close to both the city centre and the M1 motorway, has now been redeveloped into an industrial and logistics park. Rebranded as Power Park, it consists of six speculatively-built steel-framed buildings, which have a combined floor area of more than 39,000m² and will all achieve a BREEAM 'Very Good' rating.

Justin Sheldon, Director and Head of Region at Henry Boot Developments (HBD), says: "It's fantastic to see Power Park take shape – it is a high-quality, sustainable development that will attract new business and investment into the city and could create as many as 1,000 new jobs."

Jeremy Bishop, Co-Founder of Oxenwood, said: "Power Park is a very well located logistics development and the unit sizes and specification are designed to address the strong supply-demand dynamics in the Nottingham area."

Prior to main contractor Bowmer + Kirkland (B+K) starting onsite in March 2022, HBD had overseen Imperial Tobacco's decommission of the site's buildings. With an aim to be as sustainable as possible and lessen the environmental impact of the project, approximately 98% of the materials from the demolition programme have been recycled and reused.

The site's extensive timber flooring has been turned into wood pellets for use in biomass eco-friendly boilers, while steelwork salvaged from the frame of the original main manufacturing building has been recycled.

"Around 24,000m³ of crushed concrete was retained on site and we've used it as working platforms for the new buildings, yards and roads," explains B+K Senior Project Manager Andy Clayton.

To form the new buildings, steelwork contractor Caunton Engineering has fabricated, supplied and erected 1,500t of structural steelwork for the scheme.

Following on behind the project's groundworks teams, the company erected each of the main structures individually, using two 55t-capacity mobile cranes.

Pad foundations, for each building had previously been installed, while a flat working platform for the cranes and MEWPs had also been completed.

The largest of the steel-framed structures is known as Building One, and has an individual steel tonnage of 520t. The structure has three spans, with the central span of 27.5m, which incorporates the building's 19.8m-high apex.

With two internal rows of columns, arranged in a hit-and-miss configuration, the structure portal frame has two wider outer spans measuring 34.5m.

The building has an overall length of 137m, and like all of the other buildings, it accommodates an internal two-storey office block.

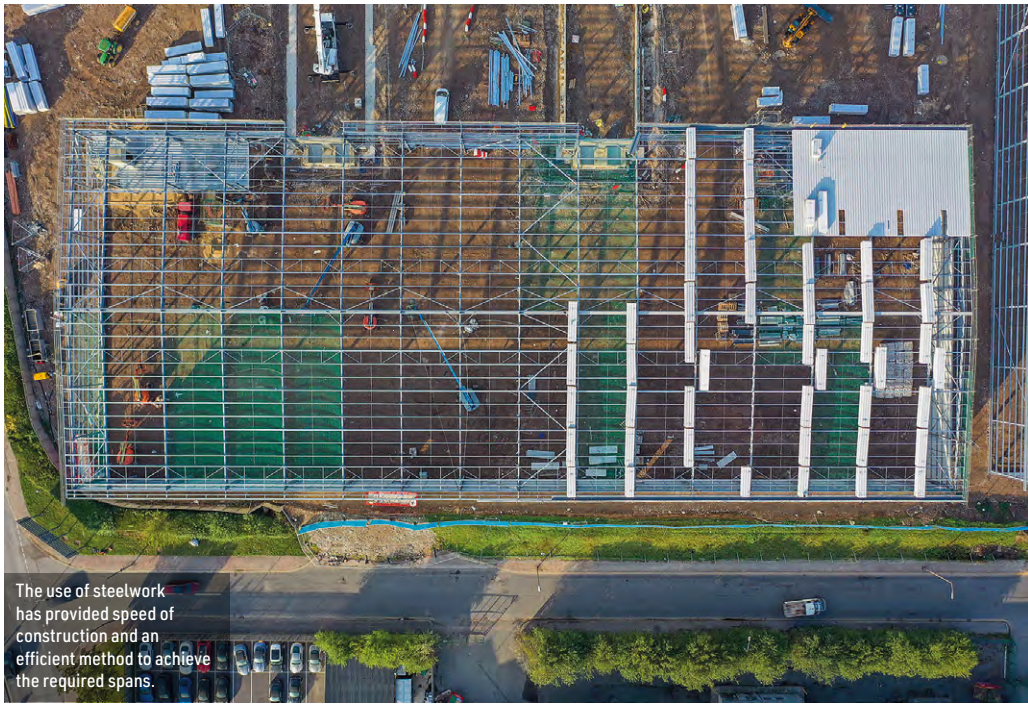
"The offices all vary in size, but they are all formed with steel columns and beams, supporting metal decking and a concrete topping for a composite design," explains Caunton Engineering Contracts Manager Dean Linthwaite. "We've also installed a metal decked roof on each of the offices."

Also, incorporating three spans, Building Five

The scheme consists of six BREEAM 'Very Good' units.


The majority of the steelwork has been erected with two 55t-capacity cranes.

FACT FILE
Power Park, Nottingham
Main Client: **Henry Boot Developments & Oxenwood Real Estate**
Architect: **Corstorphine & Wright**
Main contractor: **Bowmer + Kirkland**
Structural engineer: **BWB Consulting**
Steelwork contractor: **Caunton Engineering**
Steel tonnage: **1,500t**


The use of steelwork has provided speed of construction and an efficient method to achieve the required spans.

is the second largest structure on the scheme. Reaching a maximum height of 16m, its three spans are 26.5m-wide, while the structure has an overall length of 115m.

Offering plenty of scope for a wide variety of end-users, Building One features 14 loading docks and four level access doors, while the slightly smaller Building Five, has eight loading docks and two level access doors.

Slightly different from its neighbours, Building Three is divided into two separate units – 3A and 3B, and consequently it is classed as two individual buildings. Once the entire 120m-long × 48m-wide steel frame was erected, Caunton installed a series of columns that form a permanent partition wall that divides the building into two equal 60m-long parts.

The twin, back-to-back double-span units, both have two-storey offices, bookending the structure at either end. Each unit has two loading docks and one level access door.

Building Two and Building Four are similar prop portal structures, with the former having twin 25m-wide spans and the latter two 27m-wide spans.

Building Two is 80m long and contains an office block that is 8m-wide × 18m-long. It has seven loading docks and two level access doors.

Building Four is smaller, measuring 40m-long, containing an 8m × 21m-long office. This structure has three loading docks and two level access doors.

Power Park was completed in early April 2023. ■


Steelwork erection nears completion on Building Two, in the foreground, while roof cladding is installed on the adjacent Building Three.

"It's fantastic to see Power Park take shape – it is a high-quality, sustainable development that will attract new business and investment into the city and could create as many as 1,000 new jobs."

Sustainability in the frame

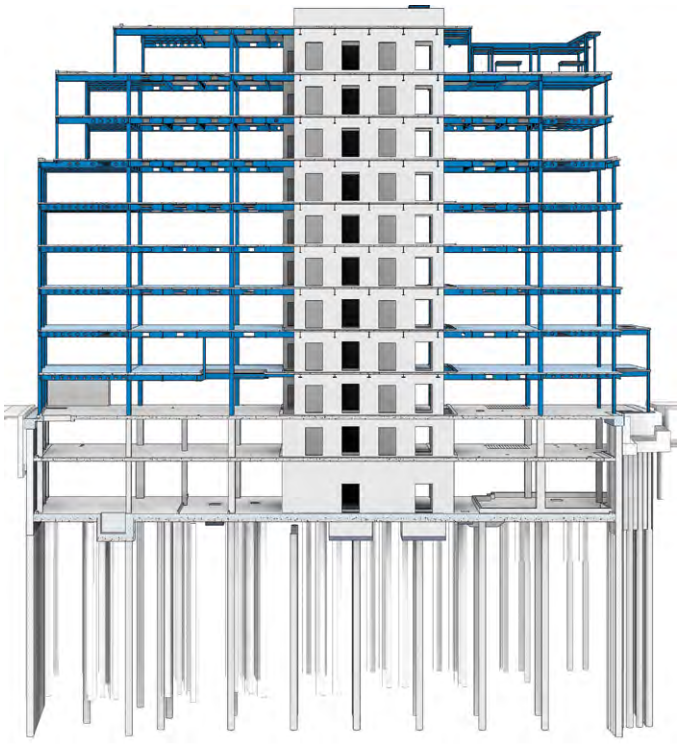
FACT FILE
Worship Square, London
Main client: **HB Reavis**
Architect: **Make Architects**
Main contractor: **HB Reavis**
Structural engineer: **Heyne Tillett Steel**
Steelwork contractor: **BHC**
Steel tonnage: **1,000t**

A number of efficiencies, including renewably produced steelwork, are contributing to a London office scheme achieving the highest sustainability and wellness targets.

Worship Square will set a benchmark for future city centre office schemes.

Cellular beams for service integration have been used throughout the project.

"A steel-framed option provided a more cost-effective and efficient method of construction for the client to create a modern office building."



The building is founded on piled foundations and a piled secant wall.

Sustainability is at the top of the agenda for one of the capital's latest steel-framed office schemes, currently under construction just beyond the northern fringes of the City of London.

Aiming to achieve a WELL 'Platinum' Building Standard certification and a BREEAM 'Outstanding' rating, the nine-storey, fully net zero carbon Worship Square will provide 13,000m² of workspace and over 800m² of outdoor terracing.

Said to have been designed to allow businesses to grow organically, the building will include a range of collaborative and flexible on-demand spaces from desks, studios and offices to meeting rooms, event spaces and an auditorium.

The building will also include a multi-functional fitness studio, with tailored classes for employees, high-end changing facilities, 324 cycle spaces to support the active commuter and free bookable Brompton bikes and e-scooters to facilitate active lifestyles.

According to international workspace provider HB Reavis, the developer and main contractor behind the scheme, the project has been designed to reduce embodied carbon by more than 50%

compared to current industry benchmarks – the equivalent of the average yearly carbon emissions for 3,000 homes and 18% better than the GLA 2030 target for commercial buildings.

The building will also be net zero carbon in operation and be free of single-use plastic, as well as fully electric. Operational energy use will be reduced through air source heat pump technology, which will create efficient heating and cooling, smart modelling and photovoltaic cells on the roof to provide onsite renewable energy.

A sustainable approach was also taken with the sourcing of the project's materials. BHC has used XCarb, recycled and renewably produced steel from ArcelorMittal, for all of the columns and beams in the steel frame.

"It was a privilege to work with the progressive team at HB Reavis. They embraced a climate positive approach during the design development of Worship Square using Histar 460 as a material and carbon reduction strategy for the multi-storey columns, and then turning their attention to the provenance of the steel and layering on XCarb recycled and renewably produced sections to deliver an ultra-low embodied carbon steel frame," explains ArcelorMittal Construction Engineer Walter Swann.

The decision to use high strength 460 steel for the columns has provided a significant reduction in weight for those elements, around 25-30%, with a corresponding reduction in embodied carbon, which was further enhanced by the specification of XCarb.

Work started onsite in 2021 with the demolition of two six-storey blocks, which were considered to be energy-inefficient, compared to the new structure currently going up in their place.

Following on from the demolition programme, where 100% of the waste was diverted from landfill, early works included the installation of a piled secant wall, to aid the construction of the double-storey concrete basement. This was followed by the construction of an offset concrete core, which provides the stability to the steel frame. and the ground floor slab.

From ground floor upwards, the building is a steel-framed structure, with steel cellular beams, supporting metal decking and a concrete topping to form a composite flooring solution.

The cellular beams have bespoke openings, and have been used as an efficient method to accommodate the building's services within the steel member's depth. Perimeter steel columns that support the building's precast concrete and glazed cladding system are spaced at 6m intervals, while internally there are spans of up to 9m.

"Originally the design for the project was for a concrete-framed building," says Heyne Tillett Steel Associate Andy Curry. "However, a steel-framed option provided a more cost-effective and efficient method of construction for the client to create a modern office building."

For the steel erection programme, BHC has made use of the site's two tower cranes. Both units have sufficient lifting capacity for all of the steel members, with the heaviest lift being 2.5t.

Logistics have been a key factor of the steel package, as the site has limited space for materials storage. The steelwork is delivered on a just-in-time basis and generally lifted on to the frame before being erected.

Keeping the neighbours happy has also been a major consideration. At Worship Square, there is a primary school located along the project's western elevation. As the playground directly abuts the new building, the project team have agreed with the school's staff to halt steel erection on this part of ▸20

▸19

the frame during school break times, when children are in the playground.

One of the main features of the building's ground floor is a double-height entrance foyer, that leads to a café, destination restaurant and breakout spaces, alongside an openable façade facing a new square.

"In and around the foyer at first floor, we have used shallower UC sections as beams in order to increase the height of the double-floor space," explains BHC Technical Manager Martin Smith.

Up to sixth floor level the structure has a regular and repeating steel layout, but from this level upwards, the structure has set-backs to form the outdoor terraces.

Matthew Bugg, Lead Architect for Make Architects, says: "The new block references the warehouse architecture of the area. At the three set-back upper levels, the cladding profile is reduced and the window reveals pronounced, creating a lantern effect, while a roof terrace offers outdoor amenities."

The set-back at level six wraps around the entire building and is up to a maximum of 5m-deep. A series of transfer beams are installed at this level, and again at 8th floor, for another terrace, to pick-up the new perimeter column lines above.

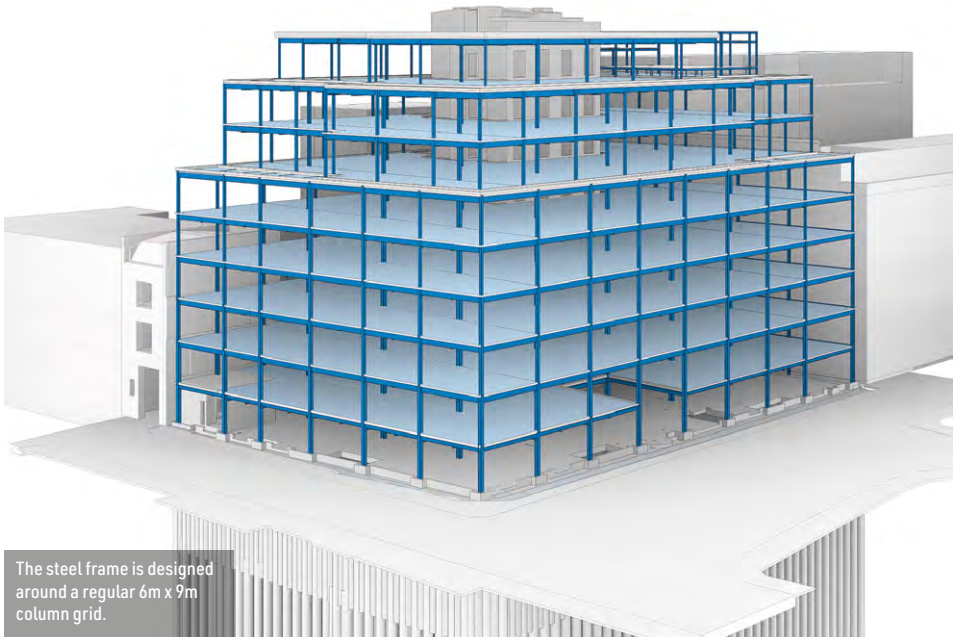
Topping the building and adding a third, and the largest outdoor space, the roof of the building accommodates a steel-framed plant area alongside a large communal garden.

With over 3,200 plants from over 49 different species throughout the scheme, Worship Square's nature-led expansive terraces are said to offer a working environment that doesn't always have to be indoors.

As well as increasing biodiversity and attracting pollinators, the large rooftop communal terrace will include urban allotments where employees can take gardening lessons to learn how to grow their own produce and a wormery to transform employees' organic waste into compost for the terraces.

Worship Square is due to complete in early 2024. ■

Amenities will include a roof top terrace.



The steel frame is designed around a regular 6m x 9m column grid.

S460 sections at Worship Square

The Worship Square project used S460 sections for the columns. Higher strength steel means reduced weight, reduced size and reduced carbon compared to S355. What's not to like? asks David Brown of the SCI.

S460 steel has been available for some time and should always be considered for columns in multi-storey buildings. As a rule of thumb, S460 might cost around 10% more than S355, but has a 30% advantage in resistance, meaning lighter columns with reduced embodied carbon can be specified. The advantage of S460 in beams is not so clear, when many are composite and the resistance is limited by other components, not the steel section, or by serviceability.

BS EN 1993-1-1 gives S460 columns a significant structural advantage in the choice of buckling curves. Minor axis buckling resistance is usually critical, where Table 6.2 of the standard specifies curve 'c' for S355 sections, but a very attractive curve 'a' for S460. The technical reason for this is that residual stresses are less significant in the higher strength steel. For a typical non-dimensional slenderness between 0.4 and 1.2, as found in multi-storey frames, the increase in resistance ranges between 30% to over 40%. Fabrication with S460 members does not bring any special concerns. The Carbon Equivalent Value – the key measure of weldability – is not significantly different to S355.

The S460 columns at Worship Square were HISTAR®, produced by ArcelorMittal, which is manufactured in accordance with a European Technical Approval (ETA). The special feature of HISTAR® is that the design strength does not reduce from 460 N/mm² until the thickness exceeds 100 mm. The design strength of S460 to BS EN 10025-4 reduces in steps at thicknesses of 16, 40, 63 and 80 mm. The ETA also specifies the correlation factor β_w to be used with HISTAR® S460 for fillet welds as 0.8, to be used if both components are HISTAR®.

HISTAR® tends to be available in heavier weights, so designers should enquire about availability. ArcelorMittal's online "Orange Book" indicates the sections available in HISTAR® and those manufactured to BS EN 10025. Resistances presented in the online "Blue Book" on steelconstruction.info assume the steel is manufactured to BS EN 10025.

Whether steel is manufactured in accordance with BS EN 10025 or to an ETA, the advantages of higher strengths, particularly in columns, are clear. Smaller sections mean less weight, less carbon and less coating, so designers are strongly encouraged to consider S460 columns as the standard choice in multi-storey buildings. ■

BCSA

Make sure your Steelwork Contractor is RQSC approved

Image courtesy of William Hare Limited

Specify an approved company from the Register of Qualified Steelwork Contractors for Buildings, to ensure your project meets the Building Safety Act requirements. As of October 3rd 2023 it will become mandatory in the NSSS that all Steelwork Contractors are RQSC approved.

Tel: 020 7839 8566
Email: postroom@bcsa.org.uk
Web: www.bcsa.org.uk/buildings-directory

RQSC

The Register of Qualified Steelwork Contractor **Buildings**

Standing tall

Structural steelwork has provided the clear span requirements for City Square House commercial development in Leeds.

Complementing a number of other city-wide developments, the last remaining undeveloped plot fronting City Square and adjacent to Leeds Station is being transformed with a new steel-framed 12-storey commercial building.

Aiming to achieve a BREEAM 'Excellent' rating, the 13,000m² of sustainable and flexible Grade A office accommodation will feature extensive reception and common areas, a double-height entrance reception, multiple terraces, cycling facilities and electric vehicle and e-bike charging points.

When the project was launched last year, the then Leader of Leeds City Council Judith Blake, said: "City Square is already at the heart of life in Leeds and we are determined to improve it still further, creating a world-class space that is a source of pride for all our residents.

"The new development will help us achieve that aim and I look forward to seeing it take shape alongside the many other transformative projects planned for the city centre.

"It also offers a timely reminder that Leeds is very much open for business. Schemes like City Square House will form part of a Leeds-wide effort to ensure our economy recovers from recent challenges in a way that leaves no one behind."

A development by MRP, City Square House is the iconic new office development that the Leeds market has been waiting for. Situated in a prominent location with unrivalled views over the city, the scheme will help to address the pressing need for quality Grade A office space in the city centre.

Highlighting the fact that structural steelwork dominates the multi-storey non-domestic sector, the project design team has chosen a steel-framed solution for this scheme.

Like many of the recent high-rise commercial developments in Leeds, a steel-framed solution was chosen by Ian Black Consulting for its speed of construction and because it offers an efficient and cost-effective method to create open-plan floorplates, with spans of up to 17m in this building.

The project's plot is wedge-shaped and takes in an area where two adjacent streets – Wellington and Aire – converge. Maximising and occupying the entire footprint, the building is also the same shape with a pointed ship-like prow pointing towards City Square.

Main contractor McAleer & Rushe commenced construction in May 2021. The site had been used as a car park for some time, following the demolition of the previous building in 2005.

A new two-level concrete substructure basement was formed, with retaining walls around all three elevations and new piled foundations, to depth of 17m, were also installed.

Encompassing the site's entire footprint, the front of the building resembles the prow of a ship, that overlooks City Square.

FACT FILE
City Square House, Leeds
Main client: **MRP**
Architect: **Todd Architects**
Main contractor: **McAleer & Rushe**
Structural engineer: **Ian Black Consulting**
Steelwork contractor: **Billington Structures**
Steel tonnage: **1,600**

With the preliminary works completed, steelwork contractor Billington Structures, which is fabricating, supplying and erecting 1,600t of structural steelwork to form the project's superstructure, were able to start onsite in October 2022.

The steel frame's columns start at basement, supporting the slabs for the upper subterranean level and the ground floor. The ground floor is split level, due to the 2m difference in street levels from Aire Street to Wellington Street.

Throughout the building, cellular beams, with bespoke openings, have been used to accommodate services and support the metal decked composite flooring solution.

The perimeter columns, which are spliced at every third floor, are spaced at 6m intervals. Internally, the building has open-plan floorplates with minimal columns.

An offset concrete core, which is positioned along the southern Aire Street elevation provides the steel frame with its stability, along with some cross bracing located in areas furthest from the core.

Having an offset core, instead of a traditional centrally-positioned core, has allowed the structure to have more internal floor space. The concrete core is also positioned within the tallest part of the scheme, which tops out at 12th floor level, and consequently needs servicing with stairs and lifts.

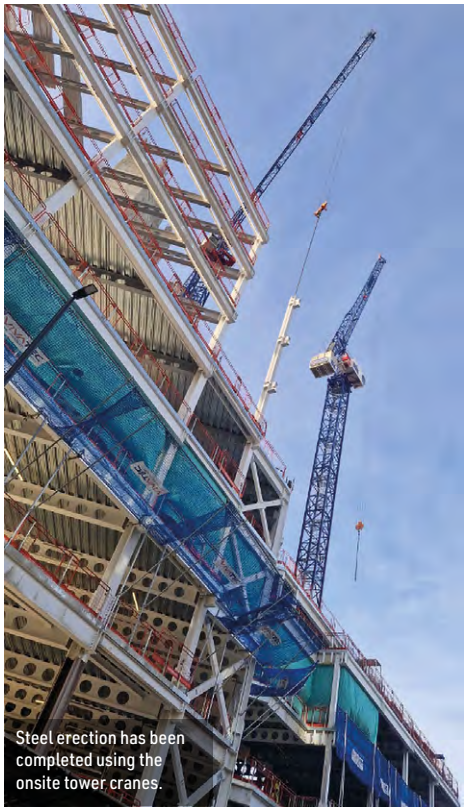
The northern elevation on Wellington Street tops out at sixth floor level where the building is set-back to form a large outdoor terrace. This elevation steps back further to provide two smaller terraces at fifth and fourth floor levels.

Designed by Todd Architects, the stepped section of the building ties into the streetscape of Wellington Street, that marks the boundary of the city's Financial Quarter, while the trapezoidal form of the taller part sets up a dynamic in the architecture, with further visual interest created in the play between the contrasting glazed and stone finishes to the building's principle façades.

Sat in the middle of the wedge-shaped structure, and separating the sixth-floor terrace from the 12-storey part of the building, there is an atrium that extends from ground to sixth floor. It will have a raised glazed roof and will allow plenty of natural daylight to penetrate the inner parts of the building.

Using the site's two tower cranes, Billington Structures says its main challenge during the erection programme has been logistics. As with many inner-city construction projects, space is at a premium on this site, with little or no room for materials storage.

Steel deliveries are made on a just-in-time basis, lifted from the truck and temporarily stored on top of the erected frame.


Steel erection has been completed using the onsite tower cranes.

Summing up, MRP Development Director Angus Montieth says: "We have been quietly going about our business of building the finest new office building in Leeds with sustainability and wellbeing at the heart of its design.

"City Square House office will quickly take shape and it will slot into place as the final piece of the regeneration of City Square."

City Square House is due to complete by the end of 2023. ■


A central atrium will allow natural daylight to penetrate the inner parts of the building.

Let the stress cover the strain

For some structures it is necessary to consider elastic behaviour, but for many a designer can adopt more simple plastic design. The latter is particularly attractive for composite construction, not least because you don't need to get into the sequence of load application, first to steel then to composite components. Graham Couchman of SCI takes a detailed look at the adoption of plastic design for composite beams (i.e. as used in buildings) in light of two recent trends that may add a certain complexity, namely the use of higher-grade steels and the use of deeper slabs.

Either of the two trends mentioned above can mean that in order to achieve sufficient curvature to strain the steel so that it approaches its plastic moment resistance, the strains in the upper fibres of concrete may go beyond the point at which crushing occurs. One way to avoid needing to consider strains explicitly is to limit the plastic moment resistance. According to Eurocode 4[1] this reduction is achieved through a so-called beta factor, which has been mildly revised, and applied to shallow floor beams for the first time, during the development of the Generation 2 Eurocode 4.

Strain and stress in a composite beam

Designers do not generally worry too much about strain. When designing a composite beam they determine the level of applied moment, and normally choose a section that has adequate resistance using simple stress blocks to determine the forces in the steel and concrete. It is assumed that the materials can strain enough to justify those stresses. When checking deflection the stiffness of the cross-section is determined based on the assumption that strains are sufficiently low that the section remains elastic, and so Young's Modulus can be used when calculating deflection values. It is generally appreciated that excessive strain could invalidate the stiffness assumptions, and codes sometimes introduce checks to ensure that yielding does not occur at serviceability. However it is also necessary to ensure that strains are not sufficiently high to invalidate the assumptions about stresses that are behind the resistance calculations.

On the assumption that plane sections remain plane as an element bends, as the curvature of a cross-section increases the absolute values of the strains throughout the depth of that cross-section, be they positive or negative, will increase. For those used to considering bending, but not curvature, the former is the curvature multiplied by the flexural rigidity *EI*. Curvature of a cross-section of a composite beam in which the steel and concrete elements were joined by infinitely stiff (and sufficiently strong) material would result in the strains shown in Figure 1a. A beam of this type would be described as having full interaction. This should not to be confused with full shear connection, which means the sum of the resistances of the connectors is not less than the maximum compressive force the concrete can resist, or the maximum tensile force the steel can resist – whichever is the smaller. Full shear connection is not related to the stiffness of the connectors. Of course nothing in the world of construction is really infinitely stiff – welded headed shear studs will have an initial stiffness of somewhere between 50 kN/mm and 100 kN/mm depending on the slab. A complete lack of stiffness, in other words a non-composite beam, results in slip at the steel to concrete interface, which manifests itself as a step in the strain diagram at that level (Figure 1b). A composite beam with shear connection having a finite level of stiffness would see strains that are somewhere between the two extremes shown in Figure 1. However, things get very complicated when slip is taken into account, so the theory and research reported hereafter ignore it, which is conservative as far as critical strains are concerned.

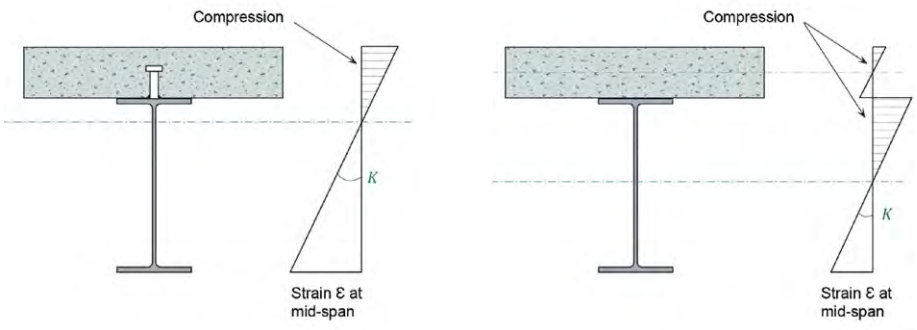


Figure 1: Strains in a composite beam with a) full interaction b) no interaction

If we now consider the stress distribution in a composite cross-section, the linear distributions of strain in the steel and concrete elements represented in Figure 1a will only be reflected in the stress distributions up to the point at which the bottom fibres of the steel yield. As curvature, and strains, continue to increase the stresses will evolve as shown in Figure 2 for a typical cross-section (with full interaction).

Identifying when curvature becomes a concern

Figure 2 shows that as curvature increases, at a certain point the bottom fibres of steel will start to yield. As curvature increases further this yielding will spread up the steel section, up to the point where a sufficient part of the section is at yield for the part that isn't, to be assumed to be (yielding over the total depth would require infinite curvature, and as noted above we do not deal with infinite things in reality). It is generally accepted that achieving $0.95M_p$ in a numerical model, which simplifies the modelling, is sufficient to represent the ultimate capacity of a beam. The work carried out by ourselves in the development of the rules for P405[2]

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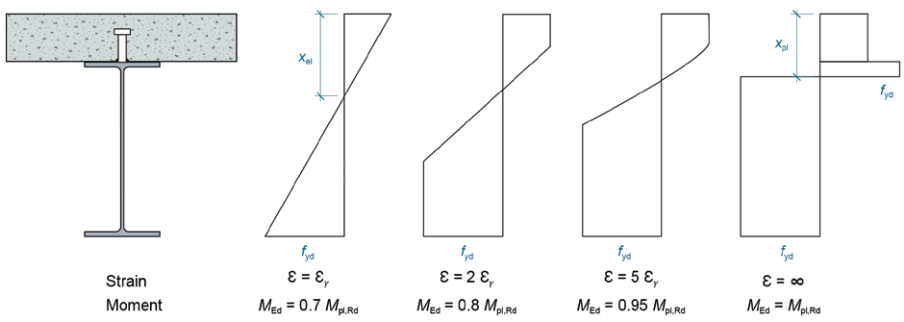

Figure 2: Evolution of stress in a typical composite cross section as curvature increases

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▸24

adopted this approach. Further increasing curvature would be no problem for the steel, in fact we may start to see some beneficial strain hardening of the bottom flange, but it may be a problem for the concrete, which will have a crushing strain of say 0.35%. The further the top fibres of concrete are from the neutral axis (so with a deep slab), or the further the curvature has to go in order to fully yield the steel (so exacerbated with higher strength steel), the more likely this is to be a problem. When concrete crushing occurs it will limit the cross-sectional resistance. At some point, which is a function of the steel grade and position of the neutral axis, one can no longer assume plastic stress blocks for both the steel and concrete, for this reason. However, it is possible to use a reduced plastic resistance such that the calculation remains simple. This reduction is achieved using a so-called beta factor.

Reducing the effective plastic moment resistance

Eurocode 4 (EN 1994-1-1 clause 6.2.1.2 (2))[1] provides a graph showing the beta factor that is to be used for composite beams using S420 or S460 steel. This graph is reproduced here as Figure 3.

This phenomenon has been investigated further in recent years as part of the development of the Generation 2 Eurocode 4. Tens of thousands of numerical simulations were used to refine the rules, and extend them to consider shallow floor beams as well as downstand beams[3]. To avoid excess complexity the simulations all considered beams with full interaction, and with reference to Figure 1 it will be appreciated that this makes the results, if anything, conservative.

Using stainless steel

SCI is currently preparing guidance that will supplement Eurocode 4 by providing rules to cover composite beams with stainless steel sections. The differing stress-strain behaviour of such steels may affect the need for, and values of, reductions in the plastic moment resistance. The yield strength of a 1.4462 duplex stainless steel beam is the same as that of an S460 carbon steel beam. However, in the duplex stainless steel beam the yield strength is reached at a larger strain. Because of this, for a composite beam in which the beam is made of duplex stainless steel, for a given curvature the portion of the steel section that has not reached yield is always going to be larger than in a composite beam with S460 carbon steel. On the other hand, because duplex stainless steel does not exhibit a yield plateau, any fibre that is strained beyond yield will develop a stress larger than the yield strength due to the earlier onset of strain hardening.

Numerical simulation has once again been used to predict values for

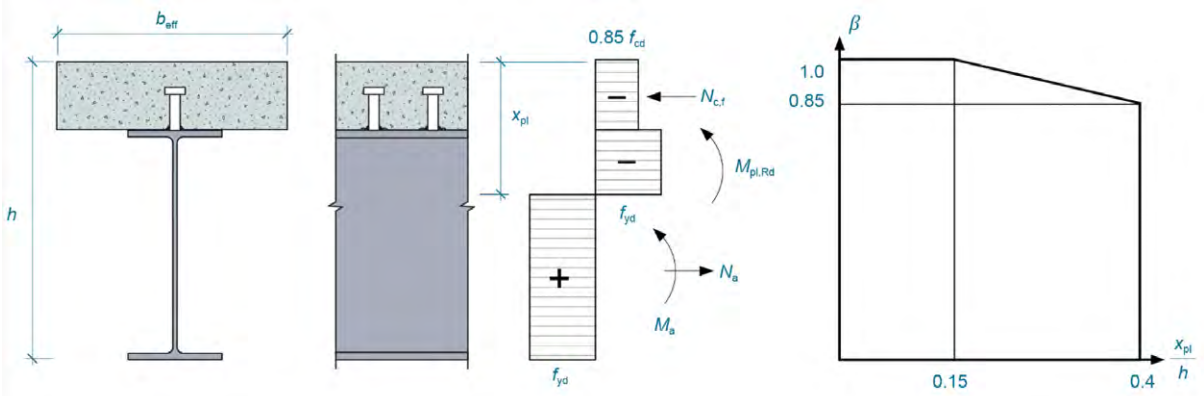

Figure 3: Reduction factor beta, applied to $M_{pl,Rd}$ according to EN 1994-1-1

beta that will result in equivalence with strain limited design (i.e. design using resistances that are limited by reaching a certain level of strain, rather than the maximum stress that can be achieved). Figure 4 shows some results, comparing values for beams with S460 and 1.4462 stainless steel.

Conclusions

Plastic design offers both simplicity for the designer, and economy of material use. However, in some situations the strain capacity of a material may limit the ability to achieve the levels of strain and therefore stress throughout a cross-section that are needed in order to justify the use of stress-blocks. For composite beams, using a reduction factor applied to the plastic resistance is one way of retaining simplicity and at the same time ensuring that premature crushing of the concrete would not invalidate calculated resistances. This article also suggests, however, that for many beams the impact of this reduction will be relatively insignificant. In other words, for these cases, the difference between the resistance calculated using strain limited design, and that for plastic design (i.e. based purely on stresses), is small. ■

References

1. BS EN 1994-1-1:2004. *Eurocode 4: Design of composite steel and concrete structures. General rules and rules for buildings* (incorporating corrigendum April 2009) BSI, 2004
2. P405 *Minimum degree of shear connection rules for UK construction to Eurocode 4*. SCI, 2015
3. Schäfer, M., Zhang, Q., Banfi, M., Braun, M.: *Plastic design for composite beams – are there any limits?* 9th International Conference on Steel and Aluminium Structures (ICSAS19), Bradford, UK, 2019

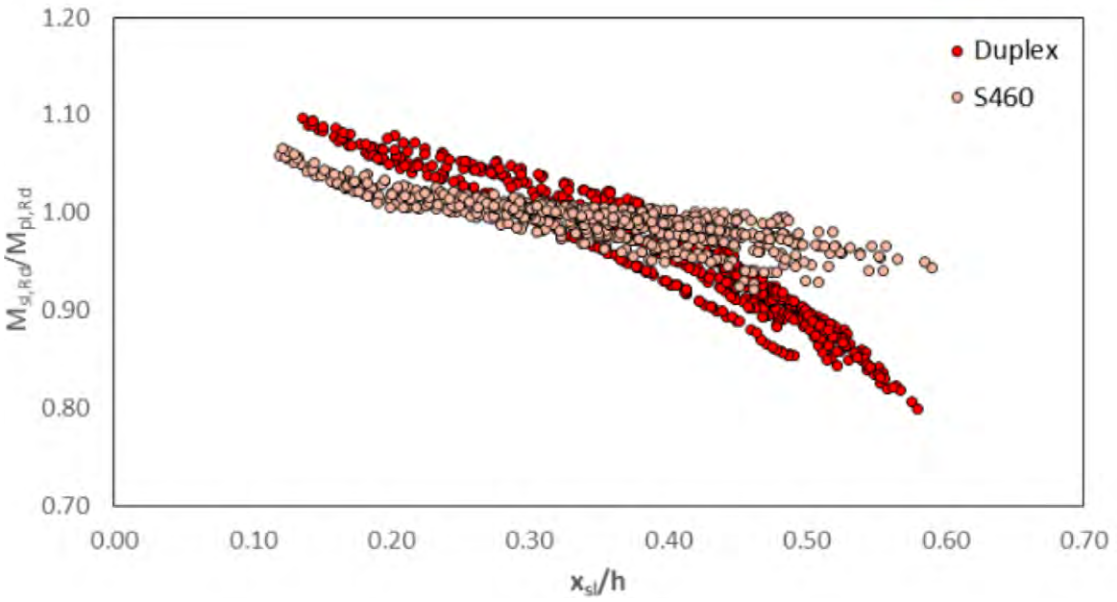

Figure 4:
Reduction factor beta for a beam with either carbon steel or stainless steel

New and revised codes and standards

From BSI Updates April 2023

BS EN PUBLICATIONS

BS EN ISO 15610:2023
Specification and qualification of welding procedures for metallic materials. Qualification based on tested welding consumables
supersedes BS EN ISO 15610:2003

BS EN ISO 5817:2023
Welding. Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded). Quality levels for imperfections
supersedes BS EN ISO 5817:2014

BS IMPLEMENTATIONS

BS ISO 4998:2023
Steel sheet, zinc-coated and zinc-iron alloy-coated by the continuous hot-dip process, of structural quality
supersedes BS ISO 4998:2014

BS ISO 13521:2023
Austenitic manganese steel castings
supersedes BS ISO 13521:2015

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS EN ISO 2400:2012
Non-destructive testing. Ultrasonic testing. Specification for calibration block No. 1

BS EN ISO 9017:2018
Destructive tests on welds in metallic materials. Fracture test

BS EN ISO 16371-2:2017
Non-destructive testing. Industrial computed radiography with storage phosphor imaging plates. General principles for testing of metallic materials using X-rays and gamma rays

BS EN ISO 16809:2019
Non-destructive testing. Ultrasonic thickness measurement

BS ISO 16162:2012
Cold-rolled steel sheet products. Dimensional and shape tolerances

BS ISO 16163:2012
Continuously hot-dipped coated steel sheet products. Dimensional and shape tolerances

NEW WORK STARTED

EN ISO 10882-2
Health and safety in welding and allied processes. Sampling of airborne particles and gases in the operator's breathing zone. Sampling of gases
will supersede BS EN ISO 10882-2:2000

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

23/30397900 DC
BS EN 1993-1-10 Eurocode 3. Design of steel structures. Material toughness and through-thickness properties
Comments for the above document were required by 23 April, 2023

23/30397909 DC
BS EN 1993-1-9 Eurocode 3. Design of steel structures. Fatigue
Comments for the above document were required by 23 April, 2023

23/30397915 DC
BS EN 1993-1-4 Eurocode 3. Design of steel structures. Stainless steel structures
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23/30443611 DC
BS EN 1993-1-6 Eurocode 3. Design of steel structures. Strength and Stability of Shell Structures
Comments for the above document were required by 23 April, 2023

23/30443614 DC
BS EN 1993-1-7 Eurocode 3. Design of steel structure. Plate assemblies with elements under transverse loads
Comments for the above document were required by 23 April, 2023

23/30455835 DC
BS EN 1991-1-1 Eurocode 1. Actions on structures. General actions. Specific weight of materials, self-weight of construction works and imposed loads for buildings
Comments for the above document were required by 23 April, 2023

23/30455838 DC
BS EN 1991-1-3 Eurocode 1. Actions on structures. Snow loads
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23/30457255 DC
BS EN 1991-1-9 Eurocode 1. Actions on structures. General actions. Atmospheric icing
Comments for the above document were required by 23 April, 2023

23/30457273 DC
BS EN 1991-1-5 Eurocode 1. Actions on structures. Thermal actions
Comments for the above document were required by 23 April, 2023

23/30458281 DC
BS EN 1998-2 Eurocode 8. Design of structures for earthquake resistance. Bridges
Comments for the above document were required by 23 April, 2023

AD 507: Galvanizing steel of grade S460M

SCI has recently been asked whether the heating of thermomechanical rolled steel of grade S460M when subject to hot-dip galvanizing will affect the properties of the material. This Note addresses this issue in the context of the production and galvanizing processes.

The product standard for structural steel of grade S460M is BS EN 10025-4:2019. Part 4 is titled Technical delivery conditions for thermomechanical rolled fine grain structural steels.

The production process involves a rolling finish temperature of 700°C, lower than the typical rolling finish temperature of 750°C. The lower temperature requires a greater force to roll the material. The process produces a fine grain structure and a tough material which is designated by the letter M. The properties are retained unless the material is reheated above 650°C[1].

Hot-dip galvanizing involves dipping the steel in a bath of molten zinc that commonly has a temperature of about 450°C[2]. The immersion time is typically 4 to 5 minutes but can be longer in certain circumstances. The temperature of the galvanizing bath is therefore below that at which the properties of the steel would be affected.

Galvanizing steels with a yield strength above 650 MPa and steels of high hardness is addressed in SCI Publication P432[3].

Contact: **Richard Henderson**
Telephone: **01344 636555**
Email: **advisory@steel-sci.com**

1 https://www.steelconstruction.info/Steel_material_properties
2 *The Engineers & Architects' Guide: Hot Dip Galvanizing*, The Galvanizers Association. https://www.galvanizing.org.uk/publications/
3 Baddoo, N, Chen A, *High strength steel design and execution guide*, (P432), SCI, 2020

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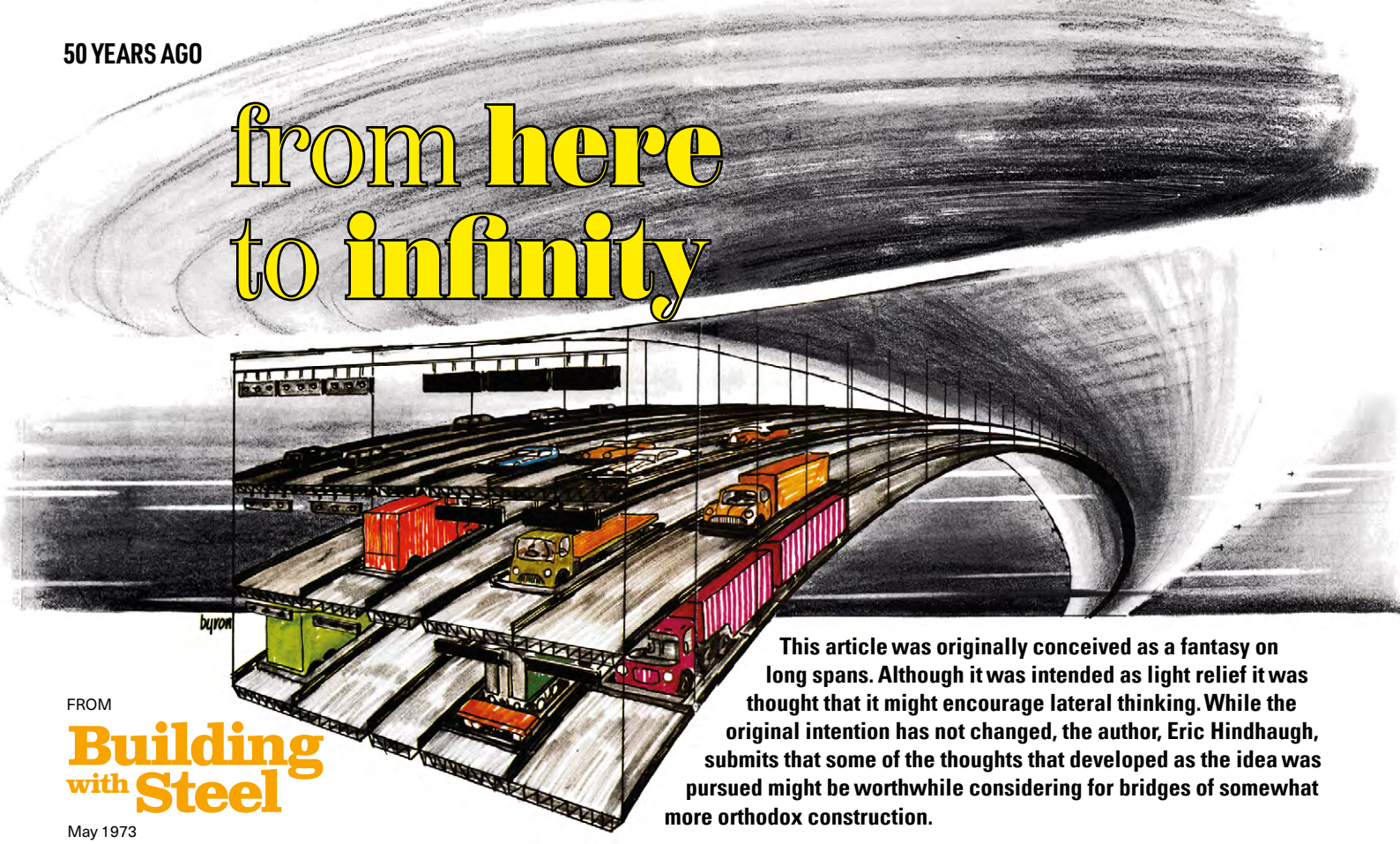


FROM
Building with Steel
May 1973

This article was originally conceived as a fantasy on long spans. Although it was intended as light relief it was thought that it might encourage lateral thinking. While the original intention has not changed, the author, Eric Hindhaugh, submits that some of the thoughts that developed as the idea was pursued might be worthwhile considering for bridges of somewhat more orthodox construction.

There are two major obstacles to the design of very long bridges. The first lies in the properties of available materials to permit long uninterrupted spans. While the 3,000m or so suggested by Dr Flint is a very useful distance, there are times when a greater opening would be advantageous. Following from the first difficulty comes the second, which is that supports are necessary and for very long crossings they are apt to get in the way of shipping. While there seems to be no reason why ships can't be brought through openings two miles wide when it is borne in mind that they ultimately have to negotiate much narrower channels at port approaches there does seem to be a fear that modern ships, tankers in particular, are so unmanoevrable that aiming through a bridge is beyond their abilities. So much for progress.

From these two points it follows that the ultimate in bridge design should have zero spans so as to eliminate the restrictions of the available materials and simultaneously infinite spans so as to eliminate the supports.

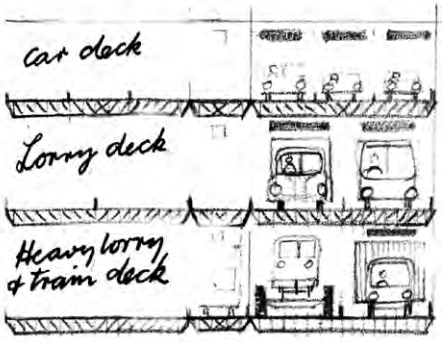
These apparently incompatible and irreconcilable requirements can be met however. While the following proposals might not be economic, might not even perhaps be practically possible (the author has no idea how much helium can be obtained), they are feasible and are interesting for what develops from them. As every reader must have gathered by now from the illustration the roadway is hung from balloons, or perhaps it would be more accurate to say from static airships. For lightly loaded structures, such as footbridges, there would be no difficulty in providing the necessary buoyancy but working on the principle of 'in for one pence in for one pound', I have examined the possibility of providing a multi-lane super highway capable of crossing (dare I mention it?) the English Channel.

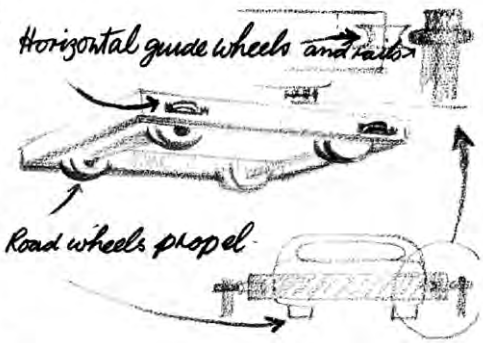
The basic proposition is to carry three decks of traffic. The upper includes three lanes in each direction for cars and light vehicles only - say up to about two tons each. The speeds in each lane would be controlled and would be 40, 55 and 70mph. The middle deck would be for medium weight commercial vehicles - say up to about 10 tons each - and would have two lanes in each direction with speeds controlled to 40 and 50mph. The lowest deck would be for heavy lorries and trains and the speeds would be 30 and 50mph.

It would be difficult, of course, to drive a long distance in a relatively narrow lane and the consequences of a driver falling asleep are not to be contemplated. For this reason it is proposed that all vehicles are totally controlled in direction and speed by the bridge itself. The modus operandi is quite simple. On arrival at the toll gates each vehicle receives a framework of standard size for its deck so that for cars, for instance, it might be about 25ft long and 10ft wide. The inside of the frame would be soft-padded to prevent damage to the car. The frame would have its own running gear for the road deck and horizontally for the guide rails. In effect then the driver has only to maintain a light hold on the steering wheel, sufficient to keep the wheels approximately straight, and a foot on the throttle to maintain his speed. The guide rails would be arranged in sections about 50ft long such that the forward end can be moved inwards to narrow the gap while the rearward end is simply hinged. The normal and failed positions of the guides are open, i.e. narrowing the track. As a car travels through, the tracks in front open to give a clear run. However, they cannot open at speeds different from the control speed for the lane unless overridden manually by the bridge staff in the event of an emergency. Should a driver attempt to exceed his set speed he would find himself being braked by the guide rails. Similarly if his speed falls below that set, he will find himself being braked. Only at the correct speed would life be comfortable. The guide rails would also be programmed to prevent vehicles getting too close to each other and the bridge would be perfectly safe to use in thick fog. In addition to the automatic braking the bridge would have sets of traffic lights shining only red or green. This would enable the driver to control his speed by keeping a set number of lights ahead on the correct colour. In addition, should there be a break-down in his lane he can apply his own brakes as well as relying on the guide rails and thus avoid pressure on the front of the car. If a car breaks down all cars behind would automatically be braked in safety. Meanwhile the rescue and break-down crew would soon be in position and would override the guides, enabling the obstruction to be bypassed and also removed rapidly to return the lanes to normal running. The middle deck would operate in much the same way.

The lowest deck would be similar but it is not thought that exceptionally heavy or bulky loads could be carried except by special arrangement, probably at night and by using both lanes.

Whereas the upper two lanes are for road traffic only, the lowest is for both road vehicles and for trains. In complete reversal to proposals





for a Channel Tunnel, I suggest that for a bridge the trains are carried by road vehicles. The reasons are several and are attractive. Loading a train with road vehicles must take considerable time as each has to be driven on, parked, braked, checked and locked. Loading a road transporter with a train is only one movement and would take much less time. No special tracks are required and normal road vehicles can run between the trains, thus there is no 'dead' highway.

Because the train is now running on pneumatic tyres it can be braked as quickly as a lorry - in fact quicker, because the guide rails would help out also. It would run silently compared with the noise of a normal train running on an all-steel bridge. Since braking is superior trains could be run at much higher intensities. The impact loads on the structure would be much less than with normal trains and this would help to reduce the bridge weight.

There is no shoulder on this bridge, as with most bridges. Nonetheless, break-downs will occur and must be dealt with quickly to prevent congestion. For this purpose there is a middle lane on each deck reserved exclusively for rescue operations. Running on each deck would be a number of combined vehicles including fire-fighting equipment, vehicle servicing of the 'get-you-home' type, cranes to remove vehicles unable to run, first-aid and ambulance and perhaps an emergency operating theatre, although since accidents are virtually impossible the last might not be required. These vehicles would be drivable from either end and should be able to reach say 100mph. In this way they could service any part of the bridge within about three minutes of being called.

Although the above operating systems were evolved for the 'infinite-span' bridge, most, if not all, would be equally applicable to any large capacity bridge of great length and might warrant further development.

Passing now to the structure it can be seen that it is suspended from the 'air ship'. Since the hangers are in pure tension their total weight is constant and independent of the number employed. This is distinct from struts where the weight will vary depending on the chosen proportions. We could therefore have one set of hangers for each cross-beam and, in effect, eliminate longitudinal beams entirely, except for alongside the central track where access to the lanes will be necessary. The cross-beams should be of lightweight construction and open lattices are suggested but other forms might be preferable. It might be worth while employ-ing a type of space frame for better load distribution.

Unlike suspension bridges, the deck system would not have to provide longitudinal stiffness, consequently no girders are included along the length. The cross girders are continuous and have high tensile wire diagonals, crossed in the central zones, so that moments are catered for in either direction. Great use is made of high tensile steel wire in the interests of weight saving.

The running surface also needs to be as light as possible. Steel plates with non-skid surfaces might be suitable or perhaps thin layers of granite-like material could provide a useful working life. In fact wear should not be very excessive - after all there should be little acceleration or braking, no cornering, no impact, no frost or rain and no sun - few roads have had it that good.

I can no longer dodge the issue of how to hold it up. Frankly, I don't know whether this would work in every respect but it seems to me that the following ideas are feasible.

The load per lineal foot of the bridge under the most adverse conditions is probably almost 11 tons. This is made up as follows: for every 100ft length there could be 3 cars, 2 medium lorries, 1 heavy lorry and 1 train (excluding locomotive) in each direction, plus central lane service vehicles. Allowing 2T per car we get:

6 cars @ 2T	=	12T
4 lorries @ 10T	=	40T
2 lorries @ 40T	=	80T
2 trains @ 100T	=	200T
1 service vehicle	=	40T
		372T
SW of structure, say		500T
		872T
SW of 'airship', say		200T
		1072T

So for 100ft length, weight is 1,072 tons and weight in lbs for 1 ft length

$$= \frac{1072 \times 2240}{100}$$

The lifting power of helium allowing for a reasonable level of efficiency is 62lb per 1,000ft³; so cu.ft required per lin.ft

$$= \frac{1072 \times 2240 \times 1000}{100 \times 62} = 387{,}300\text{ft}^3$$

Assuming that the volume of the 'airship' is given by

$$\frac{2h.b}{3}$$

then for a height of 300ft, the breadth is given by

$$b = \frac{387{,}300}{300} \times \frac{3}{2} = 1937\text{ft}$$

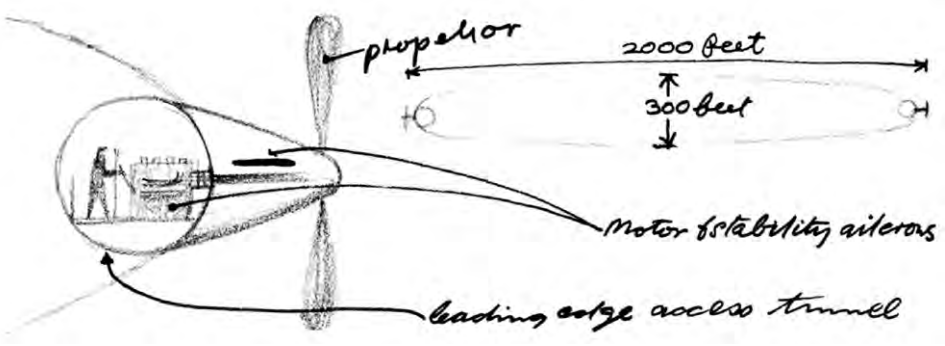
The problem now is how to keep the structure stable and in position. The height would be monitored by a number of photo-electric cells mounted on the upper surface and related to fixed installations on the cliff tops or on towers at each end. As soon as any deviation from normal is registered one of two methods could be employed to maintain height, depending on the condition. The first would be by adjusting the ratio of helium to air in the gas tanks. Since the balloon would be divided into compartments selective adjustment would be possible. The second method would be to alter the shape of the structure so as to create more or less lift from the passing airstream. There would be very few days in which there would be no wind blowing so this source of adjustment would usually be available. A combination of the two methods should cater for all needs with aerodynamic control for sensitive instantaneous correction and gas control for long-term adjustment, necessary perhaps for seasonal or night/day variations. These two methods should cater for height.

Lateral drift would be caused by wind and over the distance it could be blowing in several directions. However, if airships can fly through the wind and achieve actual movement relative to the ground, then equally with a little less power they could remain exactly in one position. The proposition is that motors (I'm not sure which type - diesel, electric, gas turbine) would be mounted along the edges of the structure and would drive airscrews. Immediate adjustment of force would be effected by blade pitch variation with longer term control by changing the motor speed. Pitch control should cater for local gust effects and motor speed with basic wind velocity. There would be a degree of stiffness in the structure and considerable inertia, so no potential movement is likely to be rapid and control mechanisms should be able to apply corrections quite easily.

The third type of movement would be pitching of the gas container by gusts hitting one edge. Again it should be possible to effect control aerodynamically by moving the edge blades. Taking into account the inertia of the structure and consequently the slowness of any movement, it seems quite feasible to expect modern control systems to maintain the position and stability of the structure within very close limits. Assuming this to be so, the bridge would have the unusual properties of being the longest span in the world and yet being free from deflection both vertically and horizontally!

The roadways would never be wet as the gas container would provide a very adequate roof. Snow would not probably get near the roads but perhaps this might be possible in a blizzard. The amount would be little, however, and could probably be deflected from the roads by quite simple means. Snow on the gas container would be most unwelcome and ice even more so. However, the skin could contain heating elements to ensure that ice would not form. Perhaps it would be possible to have a double-layer skin with hot air circulating in the cavity. This type of bridge has no span limits and could circle the earth. We could have motorways linking all countries and all continents. Strictly speaking, of course, the title of the article isn't correct, but perhaps I can be allowed a little licence as a span of 24,000 miles is not bad going.

At the present time, crossings are made by dynamic means with boats, hovercraft and aircraft, or statically by tunnels or fixed bridges. In the past these two principles were blended in pontoon bridges and the proposals in this article could be said to be a modern version of the same idea. It was good enough to get Xerxes across the Hellespont - could it be also good enough to get John Bull across the Channel? If it should be thought that the control systems would be unable to cope, I can only suggest that since it is possible to pilot automatically a fully-loaded jumbo jet across the Atlantic and land it at up to 200mph on a relatively narrow track after controlling its position three-dimensionally for 3,000 miles, it should be possible to maintain a relatively fixed structure in one position without too much trouble. Finally - how would it look? Well, this is a subjective area and it would be silly to claim that everyone should like it. But, vast though it is, the proportions are slim and I can't help feeling that this flattened silver sausage, spanning freely across the Channel and catching the myriad lights and colours from the sky, would be one of the most exciting structures known to man.



RQSC | The Register of Qualified Steelwork Contractors Scheme **Buildings**

Steelwork contractors for buildings

BCSA

The Register of Qualified Steelwork Contractors Scheme for Buildings (RQSC – Buildings) is open to any Steelwork Contractor who has a fabrication facility within the UK or European Union.

Applicants may be registered in one or more Buildings category to undertake the fabrication and the responsibility for any design and erection of:

- **C** Heavy industrial platework for plant structures, bunkers, hoppers, silos etc
- **D** High rise buildings (offices etc over 15 storeys)
- **E** Large span portals (over 30m)
- **F** Medium/small span portals (up to 30m) and low rise buildings (up to 4 storeys)
- **G** Medium rise buildings (from 5 to 15 storeys)
- **H** Large span trusswork (over 20m)
- **J** Tubular steelwork where tubular construction forms a major part of the structure
- **K** Towers and masts
- **L** Architectural steelwork for staircases, balconies, canopies etc
- **M** Frames for machinery, supports for plant and conveyors
- **N** Large grandstands and stadia (over 5000 persons)
- **Q** Specialist fabrication services (eg bending, cellular/castellated beams, plate girders)
- **R** Refurbishment
- **S** Lighter fabrications including fire escapes, ladders and catwalks

FPC Factory Production Control certification to BS EN 1090-1
1 – Execution Class 1 2 – Execution Class 2
3 – Execution Class 3 4 – Execution Class 4

BIM BIM Level 2 assessed

QM Quality management certification to ISO 9001

SCM Steel Construction Sustainability Charter
● = Gold ● = Silver, ● = Bronze, ● = Certificate

Notes
(1) Contracts which are primarily steelwork but which may include associated works. The steelwork contract value for which a company is pre-qualified under the Scheme is intended to give guidance on the size of steelwork contract that can be undertaken; where a project lasts longer than a year, the value is the proportion of the steelwork contract to be undertaken within a 12 month period.

Where an asterisk (*) appears against any company's classification number, this indicates that the assets required for this classification level are those of the parent company.

BCSA steelwork contractor member	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●	●	●				●			●		✔	2			Up to £5,000,000
Adey Steel Ltd	01509 556677	●		●	●	●	●	●	●	●	●			●	●	✔	3		●	Up to £3,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●							●		✔	2	✔	●	Up to £3,400,000
AJ Engineering & Construction Services Ltd	01309 671919			●	●		●		●	●	●			●	●	✔	4		●	Up to £3,400,000
Angle Ring Company Ltd	0121 557 7241												●			✔	4			Up to £1,200,000
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2		●	Up to £2,400,000
Arromax Structures Ltd	01623 747466			●	●	●	●	●	●	●	●				●		2			Up to £800,000
ASME Engineering Ltd	020 8966 7150			●	●	●		●	●	●	●		●	●	●	✔	4		●	Up to £5,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●			●	●			●	●	✔	2			Up to £1,200,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●	●	✔	2	✔	●	Up to £2,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●			●	✔	4	✔	●	Up to £2,400,000
Barnshaw Section Benders Ltd	0121 557 8261												●			✔	4			Up to £1,400,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	●	Above £6,000,000
Billington Structures Ltd	01226 340666	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		4			Up to £3,000,000
Bourne Group Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●		●	●	●	✔	4		●	Up to £6,000,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●						●	✔	4		●	Up to £6,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	●	Above £6,000,000
Cementation Fabrications	0300 105 0135	●		●	●	●	●	●	●	●	●		●	●	●	✔	3		●	Up to £10,000,000
CMF Ltd	020 8844 0940				●		●	●		●	●				●	✔	4			Up to £6,500,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	4			Up to £1,200,000
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £400,000
D Hughes Welding & Fabrication Ltd	01248 421104				●	●	●	●	●	●	●		●	●	●	✔	4			Up to £800,000
Duggan Steel	00 353 29 70072	●	●	●	●	●	●	●	●		●				●	✔	4			Up to £10,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	4		●	Up to £3,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●	●	✔	4	✔	●	Above £6,000,000
EvadX Ltd	01745 336413		●	●	●	●	●	●		●	●	●			●	✔	3		●	Up to £3,400,000
Four Bay Structures Ltd	01603 758141			●	●	●	●	●		●	●			●	●		2			Up to £1,400,000
Four-Tees Engineers Ltd	01489 885899	●			●		●	●	●	●	●		●	●	●	✔	3		●	Up to £2,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●	●	✔	3			Up to £1,200,000
BCSA steelwork contractor member	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**BIM**	**SCM**	Guide Contract Value (1)

BCSA steelwork contractor member	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
G.R. Carr (Essex) Ltd	01286 535501	●		●	●			●			●			●	●	✔	4			Up to £800,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●			●	●	✔	4	✔	●	Up to £5,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £4,000,000
HBE Services Ltd	01525 854110				●	●				●				●	●	✔	2			Up to £800,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●	✔	2			Up to £3,000,000
Hillcrest Structural Steel Ltd	023 8064 1373			●	●	●	●	●		●	●			●	●	✔	3		●	Up to £3,000,000
Intersteels Ltd	01322 337766	●			●	●	●	●	●	●			●	●	●	✔	3	✔		Up to £5,000,000
J & A Plant Ltd	01942 713511				●	●									●		4			Up to £40,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●				●	●					4			Up to £6,500,000
Jamestown Manufacturing Ltd	00 353 45 434 288		●	●	●	●	●	●	●	●		●	●			✔	4			Up to £10,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●		●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £10,000,000
Kloeckner Metals UK Westok	0113 205 5270												●			✔	4		●	Up to £6,000,000
Leach Structural Steelwork Ltd	01995 642000			●	●	●	●	●			●					✔	2		●	Up to £6,500,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●					●	●			●	●		2			Up to £600,000
Littleton Steel Ltd	01275 333431				●					●	●			●	●	✔	3			Up to £1,400,000
Loaninghill Fabrications Ltd	01506 858466				●				●	●	●			●	●		3			Up to £400,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●			●	●	✔	4		●	Up to £1,400,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●	✔	3			Up to £2,000,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●	✔	4			Up to £1,400,000
Maldon Marine Ltd	01621 859000				●	●			●	●	●				●	✔	3			Up to £1,400,000
Murphy International Ltd	00 353 45 431384	●			●		●	●	●		●				●	✔	4			Up to £5,000,000
Newbridge Engineering Ltd	01429 866722	●	●	●	●	●	●	●			●	●				✔	4		●	Up to £2,000,000
North Lincs Structures	01724 855512			●	●					●	●				●		2			Up to £600,000
Nusteel Structures Ltd	01303 268112						●	●	●	●				●		✔	4		●	Up to £6,000,000
Painter Brothers Ltd	01432 374400	●			●				●	●	●				●	✔	3			Up to £6,000,000*
Peter Marshall (Steel Stairs) Ltd	0113 307 6730				●	●				●	●				●	✔	3			Up to £2,000,000
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		3			Up to £2,400,000
REIDsteel	01202 483333			●	●	●	●	●	●	●	●	●	●		●	✔	4		●	Up to £6,000,000
SAH Luton Ltd	01582 805741			●	●	●				●	●			●	●		2			Up to £600,000
S H Structures Ltd	01977 681931	●		●	●	●	●	●	●	●	●	●	●		●	✔	4	✔	●	Up to £3,000,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●			●	●			●	●	✔	4			Up to £2,000,000
Severfield plc	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Shaun Hodgson Engineering Ltd	01553 766499	●			●		●			●	●			●	●	✔	3			Up to £800,000
Shipley Structures Ltd	01400 251480			●	●	●	●		●	●	●			●	●	✔	2			Up to £3,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●	●	●	●			●				●		2	✔		Up to £2,000,000
Southern Fabrications (Sussex) Ltd	01243 649000				●	●				●	●			●	●	✔	2			Up to £1,400,000
Steel & Roofing Systems	00 353 56 444 1855	●		●	●	●	●				●	●		●	●	✔	4			Up to £5,000,000
Taziker Industrial Ltd	01204 468080	●		●	●		●	●		●	●		●	●	●	✔	3		●	Above £6,000,000
Temple Mill Fabrications Ltd	01623 741720			●	●					●	●				●	✔	2			Up to £400,000
TSI Structures Ltd	01603 720031			●	●	●	●	●			●			●			2	✔		Up to £2,000,000
W I G Engineering Ltd	01869 320515				●					●	●			●	●	✔	2		●	Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4			Above £10,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●	●	●	●	●	●	●				●	✔	4		●	Up to £2,400,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £10,000,000
BCSA steelwork contractor member	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)

RQSC | The Register of Qualified Steelwork Contractors Scheme **Bridgeworks**

Steelwork contractors for bridgeworks

The Register of Qualified Steelwork Contractors Scheme for Bridgeworks (RQSC – Bridgeworks) is open to any Steelwork Contractor who has a fabrication facility within the UK or European Union.

BCSA

Applicants may be registered in one or more category to undertake the fabrication and the responsibility for any design and erection of:

- **FB** Footbridges
- **CF** Complex footbridges
- **SG** Sign gantries
- **PG** Bridges made principally from plate girders
- **TW** Bridges made principally from trusswork
- **BA** Bridges with stiffened complex platework (eg in decks, box girders or arch boxes)
- **CM** Cable-supported bridges (eg cable-stayed or suspension) and other major structures (eg 100 metre span)
- **MB** Moving bridges
- **SRF** Site-based bridge refurbishment
- **FRF** Factory-based bridge refurbishment
- **AS** Ancilliary structures in steel associated with bridges, footbridges or sign gantries (eg grillages, purpose-made temporary works)
- **QM** Quality management certification to ISO 9001
- **FPC** Factory Production Control certification to BS EN 1090-1
  1 – Execution Class 1 2 – Execution Class 2
  3 – Execution Class 3 4 – Execution Class 4
- **BIM** BIM Level 2 compliant
- **SCM** Steel Construction Sustainability Charter
  ● = Gold ● = Silver ● = Bronze ● = Certificate

Notes

(1) Contracts which are primarily steelwork but which may include associated works. The steelwork contract value for which a company is pre-qualified under the Scheme is intended to give guidance on the size of steelwork contract that can be undertaken; where a project lasts longer than a year, the value is the proportion of the steelwork contract to be undertaken within a 12 month period.

Where an asterisk (*) appears against any company's classification number, this indicates that the assets required for this classification level are those of the parent company.

BCSA steelwork contractor member	Tel	FB	CF	SG	PG	TW	BA	CM	MB	SRF	FRF	AS	QM	FPC	BIM	NHSS 19A	NHSS 20	SCM	Guide Contract Value (1)
Adey Steel Ltd	01509 556677	●		●	●	●	●				●	●	✓	3			✓	●	Up to £3,000,000
AJ Engineering & Construction Services Ltd	01309 671919	●		●	●	●	●	●	●	●	●	●	✓	4				●	Up to £3,400,000
Billington Structures Ltd	01226 340666	●		●	●	●	●					●	✓	4	✓	✓	✓	●	Above £6,000,000
Bourne Group Ltd	01202 746666	●		●	●	●				●		●	✓	4	✓		✓	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓	●	Up to £6,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●	●	●	●		●	●	●	✓	4			✓	●	Up to £6,000,000
Cementation Fabrications	0300 105 0135	●	●	●	●	●	●	●	●	●	●	●	✓	3			✓	●	Up to £10,000,000
D Hughes Welding & Fabrication Ltd	01248 421104	●		●		●			●	●	●	●	✓	4			✓		Up to £800,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●		●			●	✓	4				●	Up to £3,000,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●	●	●		●	●	●	●	✓	3			✓	●	Up to £2,000,000
Jamestown Manufacturing Ltd	00 353 45 434 288	●	●	●	●	●	●					●	✓	4			✓		Up to £10,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●			●	●				●	●	●	✓	4	✓		✓	●	Above £10,000,000
M&S Engineering Ltd	01461 40111	●	●	●	●	●	●	●		●	●	●	✓	3					Up to £2,000,000
M Hasson & Sons Ltd	028 2957 1281	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓	●	Up to £1,400,000
Millar Callaghan Engineering Services Ltd	01294 217711	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓		Up to £1,400,000
Murphy International Ltd	00 353 45 431384	●	●	●	●	●	●					●	✓	4			✓		Up to £5,000,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Up to £6,000,000
REIDsteel	01202 483333	●		●		●	●	●				●	✓	4				●	Up to £6,000,000
S H Structures Ltd	01977 681931	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓		✓	●	Up to £3,000,000
Severfield plc	01204 699999	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓	✓	✓	●	Above £6,000,000
Taziker Industrial Ltd	01204 468080	●	●	●	●	●	●	●	●	●	●	●	✓	3		✓	✓	●	Above £6,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓	✓	✓	●	Above £10,000,000
Non-BCSA member																			
Allerton Steel Ltd	01609 774471	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓		✓	●	Up to £3,400,000
Beaver Bridges Ltd	01204 668773	●		●	●	●	●	●	●	●	●	●	✓	4					Up to £3,000,000
Carver Engineering Services Ltd	01302 751900	●		●	●	●	●		●	●	●	●	✓	4			✓		Up to £3,000,000
Centregreat Engineering Ltd	029 2046 5683	●		●	●	●	●	●	●	●	●	●	✓	4					Up to £3,400,000
Cimolai SpA	01223 836299	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Above £6,000,000
CTS Bridges Ltd	01484 606416	●	●	●	●	●	●	●	●		●	●	✓	4			✓	●	Up to £1,400,000
Eiffage Metal	00 33 388 946 856	●	●	●	●	●	●	●	●			●	✓	4					Above £6,000,000
Harrisons Engineering (Lancashire) Ltd	01254 823993			●	●	●	●	●	●	●	●	●	✓	3		✓			Up to £3,000,000
Hollandia Infra BV	00 31 180 540 540	●	●	●	●	●	●	●	●	●	●	●	✓	4					Above £6,000,000*
HS Carlsteel Engineering Ltd	020 8312 1879									●	●	●	✓	3			✓		Up to £800,000
J&D Pierce Contracts Ltd	01505 683724	●	●	●	●	●	●	●	●		●	●	✓	4			✓		Above £10,000,000
Kelly's Welders & Blacksmiths Ltd	01383 512 517											●	✓	2			✓		Up to £200,000
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Up to £3,000,000
Malin Group	0141 370 5467	●			●	●	●			●	●	●	✓	4			✓		Up to £4,000,000
North View Engineering Solutions Ltd	01325 464558											●	✓	3					Up to £1,200,000
Shaw Manufacturing Ltd	01642 210716			●						●	●	●	✓	4			✓		Up to £1,200,000
Smulders Projects UK Ltd	0191 295 8700	●	●	●	●	●	●	●	●	●	●	●	✓	4					Above £6,000,000
Tecade S.A.U.	00 34 955 833 811		●	●	●	●	●	●	●			●	✓	4		✓	✓		Up to £6,000,000
Total Steelwork & Fabrication Ltd	01925 234320	●		●		●				●	●	●	✓	3			✓		Up to £3,000,000
Victor Buyck Steel Construction	00 32 9 376 2211	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Above £6,000,000

BCSA

Corporate Members

Corporate Members are clients, professional offices, educational establishments etc which support the development of national specifications, quality, fabrication and erection techniques, overall industry efficiency and good practice.

Company name	Tel
Gene Mathers	0115 974 7831
Griffiths & Armour	0151 236 5656
Highways England Company Ltd	0300 123 5000
Keiths Welding Limited	07791 432 078

Company name	Tel
MMCEngineer Ltd	01423 855939
Paul Hulme Engineering Ltd	07801 216858
QHSE-Interspect Ltd	07438 413849
Sandberg LLP	020 7565 7000

Company name	Tel
Structural & Weld Testing Services Ltd	01795 420264
SUM ADR Ltd	07960 775772

Industry Members

Industry Members are those principal companies involved in the direct supply to all or some Steelwork Contractor Members of components, materials or products. Industry member companies must have a registered office within the United Kingdom or Republic of Ireland.

QM Quality management certification to ISO 9001
FPC Factory Production Control certification to BS EN 1090-1
1 Execution class 1 2 Execution class 2
3 Execution class 3 4 Execution class 4
NHSS National Highway Sector Scheme

CA Conformity Assessment
UKCA and/or CE Marking compliant, where relevant:
M manufacturer (products UKCA and/or CE Marked)
D/I distributor/importer (systems comply with the CPR)
N/A CPR not applicable

SCM
Steel Construction Sustainability Charter
● = Gold ● = Silver
● = Bronze ● = Certificate

SfL
Steel for Life Sponsor

Structural components

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
Albion Sections Ltd	0121 553 1877	✓	M	4			
BW Industries Ltd	01262 400088	✓	M	3			
Cellbeam Ltd	01937 840600	✓	M	4	20		
Composite Profiles UK Ltd	01202 659237		D/I				
Construction Metal Forming Ltd	01495 761080	✓	M	3			
Daver Steels Ltd	0114 261 1999	✓	M	3			
Farrat Isolevel	0161 924 1600	✓	N/A				
Hadley Industries Plc	0121 555 1342	✓	M	4		●	
Hi-Span Ltd	01953 603081	✓	M	4		●	
Kingspan Structural Products	01944 712000	✓	M	4		●	
MSW UK Ltd	0115 946 2316		D/I				
Prodeck-Fixing Ltd	01278 780586	✓	D/I				
Structural Metal Decks Ltd	01202 718898	✓	M	4			
Stud-Deck Services Ltd	01335 390069		D/I				
Tata Steel - ComFlor	01244 892199	✓	M	4			
voestalpine Metsec plc	**0121 601 6000**	✓	**M**	4		●	**Gold**

Computer software

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
Autodesk Ltd	01252456600		N/A				
Fabsec Ltd	01937 840641		N/A				
IDEA StatiCa UK Ltd	**02035 799397**		**N/A**				**Silver**
StruMIS Ltd	01332 545800		N/A				
Trimble Solutions (UK) Ltd	0113 887 9790		N/A				

Steel producers

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
British Steel Ltd	01724 404040	✓	M		3B		
Tata Steel - Tubes	01536 402121	✓	M		3B		

Manufacturing equipment

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
Behringer Ltd	01296 668259		N/A				
Cutmaster Machines (UK) Ltd	**07799 740191**		**N/A**				**Silver**
Ficep (UK) Ltd	**01924 223530**		**N/A**				**Silver**
Kaltenbach Ltd	01234 213201		N/A				
Lincoln Electric (UK) Ltd	0114 287 2401	✓	N/A				
Peddinghaus Corporation UK Ltd	01952 200377		N/A				

Membership services

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
Deconstruct UK Ltd	02035 799397	✓	N/A				

Protective systems

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
Forward Protective Coatings Ltd	01623 748323	✓	N/A				
Hempel UK Ltd	**01633 874024**	✓	**N/A**				**Silver**
Highland Metals Ltd	01343 548855	✓	N/A				
International Paint Ltd	0191 469 6111	✓	N/A				
Jack Tighe Ltd	01302 880360	✓	N/A		19A		
Joseph Ash Galvanizing	01246 854650	✓	N/A				
PPG Architectural Coatings UK & Ireland	01924 354233	✓	N/A				
Sherwin-Williams UK Ltd	01204 521771	✓	N/A			●	
Vale Protective Coatings Ltd	01949 869784		N/A				
Wedge Group Galvanizing Ltd	**01902 601944**	✓	**N/A**				**Gold**

Safety systems

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
easi-edge Ltd	01777 870901	✓	N/A				
TRAD Hire & Sales Ltd	01614 304666	✓	N/A				

Steel stockholders

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
AJN Steelstock Ltd	01638 555500	✓	M	4			
Arcelor Mittal Distribution - Scunthorpe	**01724 810810**	✓	**D/I**	**4**	**3B**		**Headline**
Barrett Steel Services Limited	**01274 682281**	✓	**M**	**4**	**3B**		**Headline**
British Steel Distribution	01642 405040	✓	D/I	4	3B		
Cleveland Steel & Tubes Ltd	**01845 577789**	✓	**M**	**3**	**3B**		**Gold**
Dent Steel Services (Yorkshire) Ltd	01274 607070	✓	M	4	3B		
Dillinger Hutte U.K. Limited	01724 231176	✓	D/I	4		●	
Duggan Profiles & Steel Service Centre Ltd	00 353 567722485	✓	M	4			
Kloeckner Metals UK	0113 254 0711	✓	D/I	4	3B	●	
Murray Plate Group Ltd	0161 866 0266	✓	D/I	4	3B		
NationalTube Stockholders Ltd	**01845 577440**	✓	**D/I**	**4**	**3B**		**Gold**
Rainham Steel Co Ltd	01708 522311	✓	D/I	4	3B		
The Alternative Steel Co Ltd	01942 826677	✓	D/I				

Structural fasteners

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
BAPP Group Ltd	01226 383824	✓	M		3		
Cooper & Turner Ltd	0114 256 0057	✓	M		3		
Lindapter International	01274 521444	✓	M				

Welding equipment and consumables

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
Air Products PLC	01270 614167		N/A				

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