APRIL 2022

NSC

Ferry up the Mersey

Innovation at Ropemaker Street

New and old combine at distillery

Steel solution for recycling

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Cover Image
Isle of Man Ferry Terminal, Liverpool
Main client: Isle of Man Government
Architect: The Manser Practice
Main contractor: John Sisk & Sons
Structural engineer: AECOM
Steelwork contractor: Billington Structures
Steel tonnage: 274t

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Is your Steelwork Contractor a BCSA Member?

Choosing the right steelwork contractor is key to the success of your project. With close to 90 registered steelwork contractor members, BCSA provides plenty of choice to ensure a suitably qualified and competitive tender list.

By using a BCSA member you can reduce time, cost and risk.
Specifying a BCSA member:

- **Is easy:** Our directories are searchable and can be tailored to meet the bespoke needs of each of your projects. BCSA members are categorised by a maximum contract value each can handle.
- **Ensures you get an appropriate contractor:** Our members are pre-assessed so you know in advance that they have they specialist skills for your steelwork construction project.
- **Shows you value quality:** Listed by their quality credentials so you know that they are likely to meet the demands of your quality management system.
- **Demonstrates that you have chosen a competent contractor:** BCSA members are assessed for health and safety/CDM regulation requirements, quality of work, specialist skills, and maximum job size.
- **Ensures a competitive price:** There are over 90 member companies of the BCSA, and this provides users with plenty of choice to ensure a competitive tender list.
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The BCSA member directories' search criteria can be tailored to ensure you select a suitably qualified steelwork contractor for your next project.

By using a BCSA member not only can you be confident that you are choosing the most appropriate steelwork contractor for your project, you are also supporting the UK economy.

Steelwork Contractor Members for buildings and bridgeworks projects are listed in fully searchable directory format, as well as for BCSA's two other membership categories; industry members and corporate members.

To view the directories please visit:

www.steelconstruction.org/member-directories

Steel makes the best possible

Nick Barrett - Editor

Predictions of the end of the office are still being made and as frequently refuted, and it does seem probable that more people will spend time working from home than in the past, but most organisations and companies still seem to consider an office base essential, even if the square footage required is less.

There is a shortage of Grade A office space in most major UK cities, so the demand looks like remaining strong enough to keep the developer market encouraged to keep building. The City of London has a strong development pipeline as we report in the article on the latest sustainably strong, steel-framed landmark development, at 22 Ropemaker Street. This aims to be a BREEAM 'Outstanding' office and retail development near Moorgate Station.

Speed of construction, longer spans, shallower floors, lighter foundations as well as the wide range of other sustainability benefits came into their own when the designers opted for a steel-framed solution. Meeting some tricky engineering requirements also played a role due to proximity to Network Rail and London Underground tunnels, which was made possible by using a steel frame. Steel has allowed delivery of the 'best scheme possible' without comprising design, amenities or the identity of the building.

Construction teams on all of the projects featured in this issue of NSC can be said to be delivering the best schemes possible, a range of projects that are widely spread across the UK, from London to Norfolk, Coventry, Liverpool and Falkirk. The range of types of structure is also impressively wide.

Piling challenges were also overcome thanks to steel's lightweight qualities at the Isle of Man Government's development of a new ferry terminal in Liverpool, where ferry services have operated for some 200 years. The terminal sits within a £5Bn regeneration scheme of the docks and is riddled with old culverts and other below surface voids. As a gateway to the Isle of Man the client was also keen to have an aesthetically pleasing terminal, so most of the internal steelwork will be exposed.

Steel is bringing good cheer to the world's whisky afficionados with a new distillery reviving production at the site of the old Rosebank Distillery in Falkirk. Aesthetics are also very important here as the new facility is designed to become a tourist attraction. Steel's flexibility came to the fore when the design had to accommodate a tight site bound by a road and a canal as well as retention of the local landmark old distillery masonry chimney.

Steel had to be the intelligent choice for a state-of-the-art Materials Recycling Facility at Coventry which will employ artificial intelligence in its operations, thought to be a first. It was also a more technically challenging project than it looks at first, as we explain.

In Norwich we return to the site of the airport, which we last visited in 2017 to report on a conversion of an old hangar to an aviation academy. This time a new hangar and workshop is being created to serve Dutch airline KLM operations. The column-free spans required could only have been created using steel.

Whatever changing patterns of demand emerge as our economy develops, steel will be creating the best schemes possible.

Plans in for Edinburgh's first Passivhaus-designed high school

City of Edinburgh Council has approved plans for the new Currie Community High School, which is said to be one of the most energy-efficient schools to be unveiled in Scotland.

The project will be the first Passivhaus-designed high school in the country, setting an energy standard which reduces the amount of energy needed for heating by up to 90%. It also lowers the total amount of energy used by around 70% and minimises carbon emissions.

At the heart of the new school plans are five core elements: education, inclusion, outdoor learning and sustainability, digital learning and community access.

According to the Council, there is a strong emphasis on outdoor learning with the creation of a special terrace on the second floor providing all of the learning zones with immediate access to external teaching spaces. This focus will shape the curriculum on offer and ensure these outdoor spaces promote sustainability and link lifelong learning to the surrounding grounds of the school and community.

Health and wellbeing also feature prominently in the design with the creation of a dedicated wellbeing hub and separate wellness centre to support pupils.

Steelwork contractor forms coatings subsidiary

Billington Holdings has announced the formation of Specialist Protective Coatings, a new subsidiary that will focus on surface preparation and the application of protective coatings for products across a variety of sectors including structural steelwork, rail, highways, defence, petrochemical, energy, and infrastructure.

Specialist Protective Coatings will offer a wide range of paint treatments including anti-corrosion and fire protection systems.

It has been formed following Billington's acquisition, earlier this year, of the trading assets of Orrmac Coatings, a specialist painting company based in Sheffield.

Billington said it has been seeking to expand its painting capabilities for some time and the acquisition presented an excellent opportunity.

The former Orrmac facility has undergone a substantial refurbishment, and Billington said it is now able to service the most demanding of projects. The onsite lifting capacities for steel assemblies are said to be among the largest in the UK.

Mark Smith, CEO of Billington, commented: "It is an exciting period for Billington and we believe the addition of Specialist Protective Coatings will further strengthen the Group's market position through increased capabilities and product offerings."

Sustainable warehouse planned for St Modwen's Longbridge development

St. Modwen Logistics, a leading logistics developer and manager, said it has boosted the regeneration of Longbridge, Birmingham and surrounding areas with a £20M investment to build a 14,300m² sustainable warehouse that could create more than 300 jobs.

Known as the Longbridge 155 warehouse development, and located next to the former MG Rover plant, the project is due for completion in October 2022. It will showcase St. Modwen's Swan Standard commitment – a set of industry-leading sustainable development guidelines with a focus on responsible building practices that allows its customers to target true Net-Zero Carbon in operation.

A Whole Life Carbon model is being introduced to drive more naturally-based materials into the design, to enhance the embedded sustainability and mitigate the need for carbon offsetting.

The development is said to demonstrate a significant investment in sustainability and delivers a BREEAM 'Excellent' rating, targets an EPC A+ rating and is expected to achieve an overall carbon reduction of 53% compared with energy requirements set out in the UK Building Regulations (Part L).

Interim guidance issued for temporary fixings of metal decking

The British Constructional Steelwork Association (BCSA) has recently issued interim guidance for the design of temporary fixings of metal decking for practical construction in the UK. A copy of the interim guide can be downloaded from *www.steelconstruction.info*.

The interim guidance is the result of a comprehensive study carried out at the Building Research Establishment (BRE) between 2019-21 to investigate the behaviour of different fixing configurations for metal decking.

The investigation included a series of full-scale decking tests with different fixing configurations subject to wind uplift and a series of wind tunnel tests to determine the wind load on single storey buildings and high-rise buildings up to 15 storeys. The aim of this project was:

(i) to determine the possible loads taken by the individual fixings connecting the decking to the steelwork during the temporary fixed construction stage, and
(ii) to propose a simplified methodology for the design of such fixings.

The methodology given in the interim guidance is based on BS EN 1991-1-4 *Actions on Structures. General Actions – Wind Loads* and the UK National Annex and the measured pressure coefficients instead of the codified pressure coefficients.

By using the measured pressure coefficients, the wind uplift pressures are reduced and consequently this leads to a reduction in the forces taken by the temporary fixings. This design model shows that current standard fixing arrangements are generally suitable for buildings in the Midlands and South-Central regions of the UK and that most projects outside of these areas require heavy-duty/permanent fasteners to discrete zones of the floorplate.

Steelwork helps new station arrive on time

Using a steel-framed solution for its structures and overbridge is helping a new station in Reading achieve its scheduled planned opening later this year.

Green Park will be a new station at the northern end of the existing Reading to Basingstoke line. Travellers will be able to reach Reading's main station in just six minutes and Basingstoke in 20 minutes, with both destinations offering connections to London and beyond.

Reading Borough Council says the station will help to alleviate queues on the already busy A33 by offering an alternative sustainable mode of travel. This will be a boon to both residents and workers alike, as the station sits within the fast-growing Green Park Village residential scheme, which has plans for more than 1,000 new homes, and is adjacent to Green Park Business Park.

Working on behalf of main contractor Balfour Beatty, Bourne Rail & Special Projects (part of Bourne Group) has supplied 215t of steelwork for the project.

The steelwork forms a 15m-long overbridge that connects the station's two 150m-long platforms, while other steel structures include the east platform's main building/ticket office and an attached canopy, and a further shelter canopy structure on the west platform.

Using steelwork is said to have provided the project with a number of benefits, such as speed of construction, as well as the fact that steel elements were brought to site as prefabricated units that were lifted into place with less onsite work required.

Steel checks in for Grosvenor Square hotel project

Working on behalf of main contractor Multiplex, Severfield is currently fabricating, supplying and erecting the steelwork a new hotel project housed in the former US Embassy on London's Grosvenor Square.

Being built for Rosewood Hotels & Resorts and in partnership with developer Qatari Diar, it will be known as The Chancery Rosewood and aims to be the UK's first five-star hotel with a BREEAM 'Excellent' rating.

Housed in the iconic Grade II listed former embassy, the building is currently being reimagined by David Chipperfield Architects as a new retail destination and hotel.

It will include 139 spacious guest rooms and suites designed by Joseph Dirand, publicly accessible spaces including a variety of formal and casual dining and entertainment spaces including a grand ballroom.

NEWS IN BRIEF

Planning permission has been granted to transform the vacant Debenhams department store in the centre of Gloucester into a new sustainable City Campus for **University of Gloucestershire**. Led by architectural practice ADP, the adaptive re-use of the former department store will be a major catalyst in the reinvigoration of Gloucester's high street and its wider city centre regeneration. The campus, which will anchor the University firmly in the community, is also set to house public health, wellbeing and cultural services, to create a thriving city hub.

Developer Dominvs Group has received planning permission for a 644-bed purpose-built student accommodation scheme at 61-65 Holborn Viaduct in the City of London, supported by the **London School of Economics** (LSE).The developer said over 35% of the new beds will be affordable, meeting an urgent need for student housing in the Square Mile as the LSE seeks to increase its number of student beds from 4,500 to 6,000 over the next 5 years.

Morgan Sindall Construction has been appointed by the University of Huddersfield to build a new on-campus Faith Centre. The 1,000m² two-storey centre will provide community space, a congregational hall, separate male and female Muslim prayer rooms, a Christian and multi-faith room and a Chaplain's office. Additionally, the Faith Centre, which will meet the WELL standard, will also incorporate learning and support areas, an equipment store, and accessible toilets.

Kier has been appointed by North Somerset Council and Cabot Learning Federation to deliver a new £30.5M net-zero carbon building for Winterstoke Hundred Academy in Weston-Super-Mare. The new school building, funded by Homes England's Housing Infrastructure Fund, will be an expansion of the Winterstoke Hundred Academy and will provide 900 new pupil places when complete. Procured through the Southern Construction Framework, the expansion supports North Somerset Council's commitment to make North Somerset carbon neutral by 2030 and the three-storey 80,000m² building has been designed to achieve net-zero carbon in operation, a BREEAM 'Excellent' rating and have a 10% biodiversity net gain.

PRESIDENT'S COLUMN

The steel construction industry was calling for stability and calm after a very difficult period during and post COVID-19. Famine followed by feast didn't do anybody any favours and the relationships between suppliers and sub-contractors with Tier 2 steelwork contractors was certainly more than tested. This column is usually drafted about one month before the publishing date, so when I stated last month typical energy prices increases assumed no invasion of the Ukraine, they turned out to be of little use. Obviously, the "tanks rolled in" and the world is in a different place. Our hearts go out to all those that are suffering, and I'm sure we are all hoping that common sense will prevail sooner rather than later. Sanctions will affect our industry, particularly for the bridge market; energy prices have spiked and we've seen steel prices increase by £250 per tonne with little or no notice. What chaos this will bring in a buoyant market is very difficult to predict, but sooner or later, somewhere some of the links in the chain from Client to Tier 1 contractors to Tier 2 sub-contractors and Tier 3 sub-contractors/suppliers are going to start breaking and when it starts in earnest, more failures will occur due to the domino effect of uninsured debts.

It is very annoying that steel price increases are always headline news, whereas similar material increases elsewhere in the construction market always appear to travel under the radar. I'm left wondering how the market, which has always been fiercely competitive from Tier 1 to Tier 3, is going to cope in a new world order where fixed prices might be the exception rather than the rule. With all the things that have happened over the last couple of years, I've been amazed with how resilient the steel construction industry has been to absorb these continual metaphorical "punches". I think some of us feel we've taken more punches than "Rocky" recently.

As previously mentioned, other than the problems with unstable increases in material, energy, and wage costs etc, the steel construction market is buoyant at the present time. Opinion is divided on how long this buoyant market will continue for, some think it might change in early 2023, others think positive market conditions could continue for another two to three years. I guess nobody really knows for sure, but there are signs from other industries that things are just starting to stabilize. More worryingly, how many companies are now starting to see problems with cash flow? Reverse VAT doesn't help with this regard, but that battle was lost long ago. With rampant inflation will come an increase in interest rates. Commentators talk of base rates of 3%; I wonder how many people remember base rates north of 14%.

With all of the restrictions of COVID-19 being lifted, the BCSA will be holding the AGM and the Annual Dinner again this year, on 30th June in London. It would be great to see as many BCSA members as possible at both events. We are promising to reduce the heavy speech at the Annual Dinner, so that we have more time to enjoy the professional entertainment and to mingle and catch up at the bar.

Mark Denham
BCSA President

Fabsec Firebeam license available to design engineers

Fabsec cellular beam designer has announced that its Firebeam (FBEAM) Software is now available to all design engineers.

Designing plate girders for the fire condition is an established regime within FBEAM that has been used for many years by the Fabsec technical team. Fabsec said this new development will enable engineers to ensure their designs are not only structurally efficient, but also achieve the required structural fire resistance period. FBEAM can engineer the beams to suit the user specified fire durations in 15 minute increments up to 120 minutes.

The introduction of the Government's new Fire and Safety Acts will increase responsibilities and legal obligations that designers and specifiers of buildings will need to be cognisant of, along with the potential impact it may have on their liability.

Fabsec said that to help customers meet these changes it has broadened the scope of design features available within FBEAM. A cellular beam designed within FBEAM, which is procured from a licenced FBEAM fabricator and is coated in Sherwin Williams low VOC FIRETEX intumescent products, provides a fully warrantied system to help meet these obligations.

Fabsec FBEAM software can be downloaded in the UK from *www.fabsec.co.uk*

Work starts on latest New Bailey office development

Designed by Make Architects, steel erection has started on the latest phase of the New Bailey mixed-use scheme in Salford.

The 12-storey building is being built on plot A3 by Bowmer + Kirkland and will feature living walls supported by the steel frame.

The developer is English Cities Fund (ECF), which comprises Muse Developments, Legal & General and Homes England.

ECF Development Director Leon Guyett, said: "Despite the unprecedented times that we find ourselves in, we're still seeing a demand for high-quality office space in the Greater Manchester region. At ECF, together with our partners, we're committed to building back better in a bid to delivering tangible sustainability outputs, as the city region drives to be net-zero."

Having achieved the Gold Standard for the Steel Construction Sustainability Charter every year since 2007, EvadX is the project steelwork contractor.

Cumbernauld town centre set for major transformation

North Lanarkshire Council has confirmed an agreement to purchase The Centre Cumbernauld as part of its plans for a major redevelopment of the town.

The Centre Cumbernauld was built in the late 1960s as part of the new town development. It is expected to be replaced with a new town hub that will include schools, leisure facilities, office space and a new health centre.

Councillor Jim Logue, Leader of North Lanarkshire Council, said: "The acquisition of The Centre Cumbernauld is an extremely significant part of the town vision for Cumbernauld and would represent a huge step forward in the regeneration of the town.

"While the building represented the future in the 1960s, it is clear that it does not fit with residents' vision of what they need from a modern town centre.

"We are absolutely committed to ensuring that Cumbernauld – and all the towns in North Lanarkshire – is a vibrant, living town and our overall investment in town centres is about ensuring a sustainable future."

Manufacturer Farrat welcomes local MP

Founded in 1959 and renowned for its manufacture of components for acoustic isolation/insulation, building and machinery vibration control as well as products to create thermal breaks, Farrat has welcomed local Altrincham MP Sir Graham Brady to its facility.

Farrat Commercial Manager Chris Lister said: "It was fantastic to host the visit to our Altrincham site and be able to show the hub of our global operations in the heart of his constituency.

"We are strong supporters of the BCSA drive to fully utilise British supplied steel and the world-class fabrication and design services found in the UK, which we are proud to be a part of."

Sir Graham Brady was impressed hearing not only of the complexity of projects Farrat is involved with, but the investment it makes in the local community, sponsoring PhD students and giving presentations to schools targeting the STEM curriculum.

Farrat Production Manager Gareth Hogburn gave a tour of the manufacturing facilities, explaining the process of how the company gets from raw material to end products.

He also explained the research that is ongoing into finding more sustainable and eco-friendly materials with the same inherent performance requirements for the future – making their products more easily recyclable when the building they have been installed in comes to the end of its life.

Left to right: Farrat Production Manager Gareth Hogburn; BCSA CEO Dr David Moore; BCSA Strategic Marketing Manager Zoe Williams: Altrincham and Sale West MP Sir Graham Brady; and Farrat Commercial Manager – Structural Thermal Breaks Chris Lister.

Work set to start on Oxford railway station upgrade

Kier has been appointed by Network Rail to deliver the detailed design and enabling works package at Oxford railway station, as part of the Oxford Corridor Phase 2 Project.

The company said it has secured the contract to take Phase 2C and 2D of the project through Governance for Railway Investment Projects (GRIP) Stage 5 ahead of the final funding decision by the Department for Transport, which is expected in the coming months.

Phase 2C Botley Road enhancement includes the replacement of the existing railway bridge with a new, longer span structure which will incorporate 4m-wide cycle/footways on either side of the road.

Highway lowering and realignment will provide additional height clearance resulting in double-decker buses being able to comfortably pass underneath the bridge for the first time.

Phase 2D platform 5 and station improvement works will involve the construction of an additional platform and overhead canopy, a new western station entrance, ticket office, waiting room, toilets, café and shops, alongside the construction of a subway to connect the western entrance to the new platform.

Contractor named for major Cardiff education campus

Cardiff Council has announced that ISG has been selected as the preferred bidder for the design and build of a new joint education campus, to be located in the Fairwater area of the city.

The project will be the largest, in scale and investment, of Cardiff's education developments delivered under Cardiff Council and Welsh Governments Band B Sustainable Communities for Learning Programme. Three new build schools will be located on one site, becoming home to Cantonian High School, Riverbank School and Woodlands High School.

ISG will undertake the detailed design and build process for the scheme, including the temporary accommodation associated with the works. Said to be a trailblazing development, the scheme will set the standard for future school projects. It is Cardiff's first school campus to be operationally net-zero carbon, also targeting significant reduction in embodied carbon during build stage of the project.

Subject to planning and procurement, work on the new campus is expected to begin in 2023.

Diary

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

Tue 26, Thu 28 April 2022
Plate Girder Design
Online
Plate girders in buildings may be used for long span heavily loaded members, particularly if dimensional constraints make a rolled section inappropriate. This short course will discuss all design aspects, including initial sizing, cross-sectional resistance and the resistance of stiffened webs. The final part of the course will consider fabricated girders with thin corrugated webs – a form of construction in common use in other countries.

Mon 16, Wed 18, Tue 24, Wed 25, Thu 26 May
Steel Building Design to EC3
Online
An overview of the Eurocode provisions for steel building design. The course focuses on orthodox construction, covering the primary design issues for practicing engineers. The course follows the process of determining actions, considering combinations of actions, frame analysis and the assessment of second order effects. The course will then demonstrate how the resistance of members are calculated, but also how they can be extracted immediately from resources such as the 'Blue Book'.

Tuesday 17 May 2022
Fire Resistance of Light Steel Framing
Webinar, SCI/BCSA members only
The webinar will cover the fatigue phenomenon and the assessment of fatigue life. Fatigue loading and Miner's summation of fatigue damage and how it is dealt with by EN 1993-1-9 will be addressed.

Go-ahead given for major Farringdon refurbishment scheme

Developer Welput and its funding partner BentallGreenOak have received planning consent for the refurbishment and extension of its Farringdon Road Estate to deliver high quality, sustainable commercial space.

Designed by Fathom Architects, the scheme at 143-157 Farringdon Road will revive and extend a series of four former warehouse buildings in Clerkenwell. The scheme targets significant improvements to the carbon footprint of the assets and is said to create a coherent new identity designed to enhance the tenant experience.

Rebecca Thomas, Director at Fathom Architects said: "Creating renewed life and purpose for existing buildings is a challenge we love at Fathom. The Farringdon Road building is a robust warehouse in a fantastic location, but just wasn't working from either an occupier or landlord perspective. Through a rigorous process of research and collaboration with our client and consultant team, we are very proud to have developed a design which revives this handsome Victorian building as a desirable modern workspace which supports wellbeing and has high sustainability credentials."

Contractor appointed for Middleton College expansion

Caddick Construction has secured an £8.1M project to deliver a 1,393m² extension, alongside the refurbishment of the Henry West Building, Technology Centre and Annex at Hopwood Hall's Middleton Campus in Manchester.

The project is set to expand Hopwood Hall College and University Centre's delivery of T-Level qualifications, which provide a two-year technical qualification for 16 to 19-year olds.

The College was one of the first to be approved by the Department for Education to deliver the T-Levels, which provide a variety of classroom-based learning with specialist teaching expertise alongside industry work placements.

Lewis Crichton, Head of Facilities and Risk Management at Hopwood Hall College and University Centre, said: "Hopwood Hall College has an extensive and wide array of facilities, supporting a host of curriculum areas. The targeted investment into the College's Technology Centre will expand on this offering by introducing a new Advanced Manufacturing Centre, along with expansion of current facilities to meet demand in other construction and engineering disciplines."

The Caddick Construction team is set to complete the work in spring 2023.

Green light for University of Stirling research hub

Stirling Council has approved plans for a £17M world-class research and innovation facility at the University of Stirling.

The National Aquaculture Technology and Innovation Hub (NATIH), which builds on the University's internationally renowned Institute of Aquaculture, will bring together experimental aquatic facilities, including a new tropical aquarium, with state-of-the-art laboratories, and space dedicated to business incubation and acceleration.

The Hub is funded through a £17M investment from the UK Government, as part of the Stirling and Clackmannanshire City Region Deal.

Aquaculture, the cultivation of fish, crustaceans, aquatic plants, algae and shellfish in water environments, is one of the world's fasting growing sectors, with an estimated global growth rate of 8%. NATIH will position University of Stirling expertise at the forefront of this expansion, delivering and increasing the economic, social and environmental benefits for the industry, and informing modern commercial aquaculture markets.

22 Ropemaker Street's design revolves around four distinct blocks separated by recesses.

FACT FILE
22 Ropemaker Street, London
Developer: **Old Park Lane Management**
Architect: **Make Architects**
Main contractor: **Skanska**
Structural engineer: **Waterman Structures**
Steelwork contractor: **William Hare**
Steel tonnage: **6,300t**

Rising with ladder frames

A stability balancing act is at the heart of the design for 22 Ropemaker Street, a landmark City of London steel-framed office development. Martin Cooper reports.

Construction in the commercial sector is continuing apace in many areas of the UK with the City of London once again leading the way.

A number of high-profile, high-rise office schemes are currently under construction and expected to complete within the next eighteen months.

According to the latest survey from independent market research consultants Construction Markets, structural steelwork dominates the UK multi-storey non-domestic sector and last year its market share was up from 64.7% in 2020 to 65.5%. Within this sector, steel accounted for 76.9% of the private offices market, an all-time high, surpassing the 73.8% it took in 2020.

One of the largest steel construction office projects currently on site is 22 Ropemaker Street, which is situated close to the City of London's northern boundary. This commercial scheme consists of 38,900m² of Grade A BREEAM 'Outstanding' office space and 1,094m² of ground level retail.

Stability is derived from a combination of Vierendeel trusses and concrete cores.

The project also includes a double-height entrance and lobby along Ropemaker Street, which is close to Moorgate Station, and a separate dedicated cycle entrance. A single storey of business space will be located at mezzanine level and above this office space will cover 22 floors, with five accessible roof terraces. Below ground, basement levels are provided for retail servicing, plant, facilities management, cycle and shower facilities.

The use of a steel-framed solution offers a number of benefits for the construction of high-rise offices, such as speed of construction, longer spans and the creation of shallower floors, all of which have benefited the Ropemaker Street project.

Another important benefit of a steel frame is the fact that it is a lighter option than many other alternative framing solutions, which was a consideration when this scheme was being designed.

Crossrail, Network Rail and London Underground railway tunnels are located to the east and south of the site, beneath Finsbury Pavement and Ropemaker Street, and influenced the design of the project's foundations.

"The proximity to the underground transport assets meant the foundations were limited to secant piles around the perimeter, supporting a raft. Consequently, a lightweight steel frame above this was the best option," explains Skanska's Engineering Manager Chris Field.

"The depth of the basement was also dictated by the tunnels in terms of the ground movements that would result from demolition and reconstruction, and the resulting movement of the tunnels in the vicinity. The majority of the footprint has a three-level basement, but the eastern side is only one level deep."

Above ground the steel-framed structure features a series of four stepped slices that protrude forward and recess back, facilitating a range of floorplates that can accommodate different-sized businesses.

According to Make Architects, these stepped heights create space for roof terraces, and most of the office floorplates have balconies, meaning virtually every floor has access to outdoor amenities.

Along the main Ropemaker Street elevation, these architectural protruding slices are formed with four ladder frames, that extend to the full height of each part of the building. From east to west, these slices top-out at levels nine, 20, 25 (including two uppermost plant floors) and 22. With the exception of the tallest segment, each of the other slices has a landscaped terrace on its roof.

Between each protruding segment there are three glazed recesses, one of which housing a feature staircase. From east to west they top-out at levels 14, 22 and 22, with the former accommodating a rooftop terrace.

The ladder frames are designed as Vierendeel trusses that work in conjunction with the cores to provide the structure's stability.

"A steel frame was chosen as part of the structural strategy for the building as it provided an innovative solution to meet the required building stability that resulted from the asymmetric core layout," explains Make Architects' Robert Lunn.

"We worked closely with the structural engineer to investigate and develop different framing strategies which helped to inform the overall architecture and appearance of the building. The Vierendeel 'ladder' frame design creates a harmonious design whereby the structure is fully integrated into the appearance of the building, both of which work together creating a strong identity for the building."

Adding a further explanation, Waterman Structures Director Julian Traxler says: "The building's four cores are positioned along the rear northern elevation and because two of them are slim satellite cores predominantly accommodating services they don't provide enough overall stiffness.

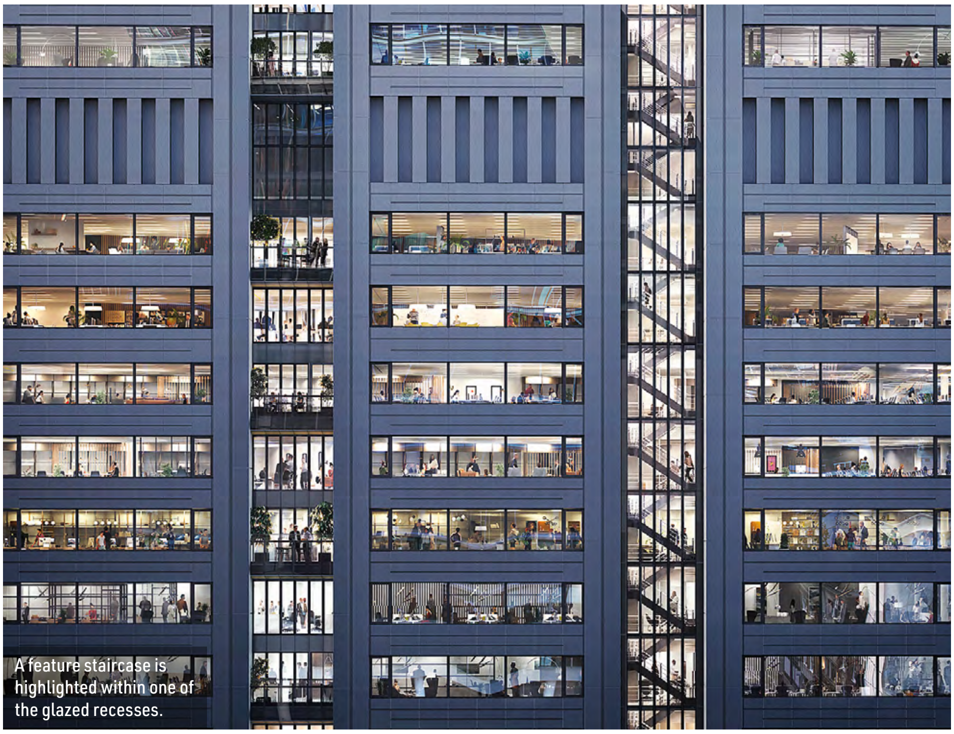
"The cores offer stability in the east west direction, while the ladder frames provide the stiffness in the north south axis and prevent any racking."

Corresponding with the building's overall 12.5m × 9m column grid pattern, the ladder frames are formed with a series of 12.5m-long x 800mm-deep fabricated box section beams, each weighing 8t and positioned at each floor level. They are supported by box section columns, spliced at every second-floor level, with each column section weighing approximately 12t.

Representing some of the heaviest individual steel elements of the entire project, William Hare delivered the ladder frames to site in transportable loads that consisted of two columns and one beam. These were then installed by one of the site's three tower cranes.

"The proximity to the underground transport assets meant the foundations were limited to secant piles around the perimeter, supporting a raft. Consequently, a lightweight steel frame above this was the best option"

Large fabricated box sections form the four ladder frames.



A feature staircase is highlighted within one of the glazed recesses.


Two of the recesses will create break-out spaces and circulation space for the offices.


Cellular beams accommodate building services within their depth.

Due to the fact that two of the cores are slim structures (resembling L-shaped shear walls), the construction of the cores has been varied. The two main central cores, serving the uppermost parts of the structure have been slip-formed prior to the steel erection programme starting. The most westerly core was also slip-formed initially up to level eight, where it transitions from a lift and stair core to only accommodating services. From this floor upwards, the slimmer concrete structure would not have had sufficient stability on its own, so it was jump-formed, with the concrete contractor always working three floors above the steel erection and thereby using the completed steel frame for stability.

In a similar procedure, the slim service core on the eastern elevation, that extends up to level nine, was also jump-formed.

Internally and above ground floor, the steel frame consists of fabricated beams supported by CHS columns. The beams have an array of bespoke web openings to accommodate the building's services and also support metal decking and concrete topping to form a composite flooring solution.

"As the majority of the internal columns will be exposed in the completed building, the CHS sections were specified as an architectural feature," says William Hare Project Director Richard Mosek. "Consequently, once the concreting of the floors is completed, each of the circular columns has a high-decorative paint finish applied."

Summing up, Stuart Bodman, Head of Development at Old Park Lane Management, says: "With a large-scale project like 22 Ropemaker Street there are many factors that require careful consideration, from the speed of construction to the lightness of the frame, which was especially important given the building's proximity to such an important transport hub.

"Providing outstanding office space for a variety of different-sized businesses, as well as generous landscaped terraces, required a range of floorplates to be accommodated in the frame. It became clear early on that having a steel frame would enable us to deliver the best scheme possible without compromise on the design, amenities or identity of the building."

22 Ropemaker Street is scheduled to be complete by July 2023. ■


Outdoor terraces provide one of the project's stand-out features.

The Liverpool terminal will provide modern facilities for one of the Isle of Man's most important gateways.

Ferry terminal docks on River Mersey

The Isle of Man Government is investing in a new ferry terminal to serve one of its vital sea links to the United Kingdom. Martin Cooper reports from Liverpool.

Said to be the oldest continuously operating passenger shipping company in the world, the Isle of Man Steam Packet Company will have a new modern steel-framed ferry terminal in Liverpool by the middle of next year (2023).

Founded in 1830, in order to provide a reliable and regular shipping service to and from the island, today the company operates between Douglas and four destinations: Belfast, Dublin, Liverpool and Heysham. The latter route operates year-round, while the other three destinations have seasonal services.

Cementing the historic links between the Isle of Man and Liverpool a new terminal is being constructed at Princes Half-Tide Dock, 675m downriver of the current Pier Head facility.

FACT FILE
Isle of Man Ferry Terminal, Liverpool
Main client: **Isle of Man Government**
Architect: **The Manser Practice**
Main contractor: **John Sisk & Sons**
Structural engineer: **AECOM**
Steelwork contractor: **Billington Structures**
Steel tonnage: **274t**

It sits within Peel Land and Property's Liverpool Waters, a £5bn regeneration scheme, which is transforming 60 hectares of the city's north docks and includes the development of numerous residential, commercial and leisure facilities as well as the new Everton FC stadium.

Commenting on the scheme during a ground-breaking event in January 2020, the then Isle of Man Chief Minister, Howard Quayle said: "The Isle of Man and Liverpool share a strong relationship based on our maritime connection, with a ferry route which has operated for more than 200 years. This development stands alone as the only construction project we have undertaken away from Manx shores."

Working on behalf of main contractor John Sisk & Sons, Billington Structures is fabricating, supplying and erecting 274t of structural steelwork for the project. The majority of this total tonnage [237t] is required for the main terminal building, with the remainder needed for three smaller structures: a security building, a check-in structure and a staff facility.

"Steel-framed buildings were chosen for this project as they needed to be lightweight to assist the piled foundation solution," says John Sisk & Sons' Engineer Conor Keating.

"The ground presented a number of challenges for the piling as the site is a reclaimed historic dock

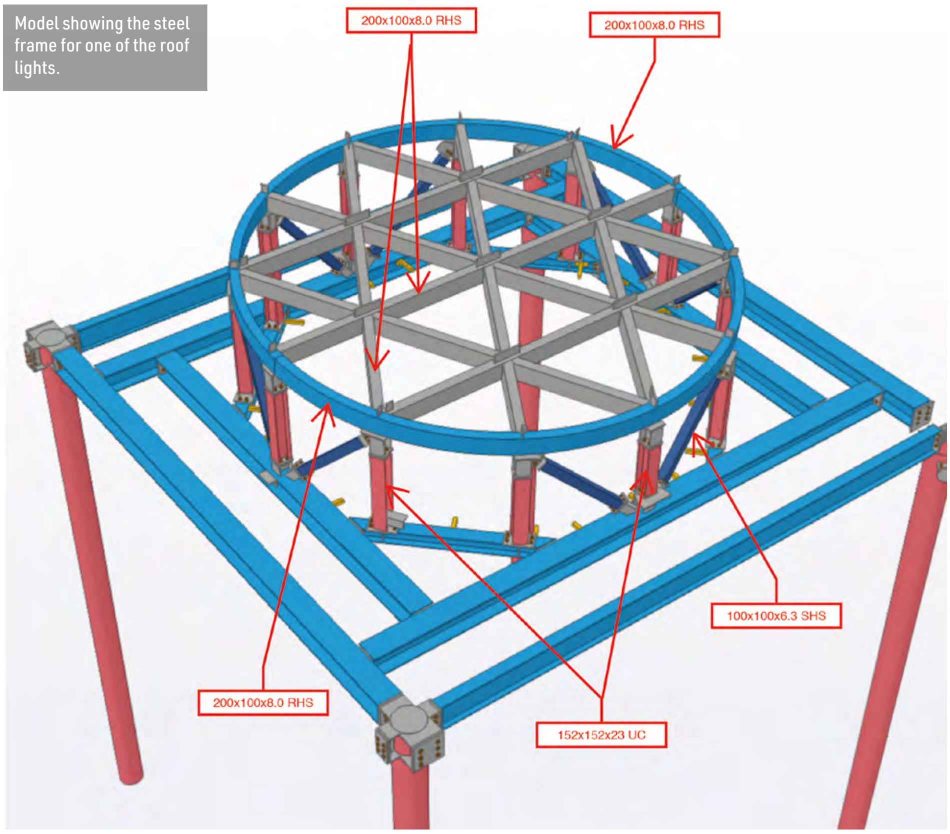
The main contractor's scope of works also includes the restoration of the historic dockside walls.

"Steelwork was also the best option to form the three 7m-wide spans economically, while tubular columns were chosen as an architectural feature because the majority of the steelwork will be exposed within the completed building."

Three funnel-like roof lights provide the a nautical element to the ferry terminal.

The terminal building features a cantilevering canopy.

Model showing the steel frame for one of the roof lights.



that has been altered several times over its history, as well as containing a large number of voids and culverts, some of which hold tidal waters."

As well as preparing the ground for the terminal building, John Sisk & Sons is also repairing and protecting the historic dock wall, creating a slipway for the disembarking and embarking of vehicles, dredging the riverfront to make it deeper and creating car parking, waiting and drop-off/pick-up areas.

The terminal building is a rectangular two-storey structure measuring 62m-long × 21m-wide and 7.5m-high. CHS members have been used for all of the perimeter columns as well as the two rows of internal columns.

"Steelwork was also the best option to form the three 7m-wide spans economically, while tubular columns were chosen as an architectural feature because the majority of the steelwork will be exposed within the completed building," adds Mr Keating.

An exposed internal steelwork aesthetic is said to be part of the project's overall look and feel, reflecting its industrial setting and also its functional use.

The ground floor of the terminal building will have an in-situ concrete ground-bearing slab, while the upper floor is formed with cellular beams supporting metal decking and concrete topping to create a composite flooring solution.

The design of the building also revolves around a circular flow of passengers. Those wishing to board the ferry by foot (car passengers check-in separately and wait in their vehicles) will enter the terminal via the entrance/exit at the western end of the building, go up to first floor via an escalator or lift and then proceed along the first floor to the boarding walkway at the eastern end.

Arriving passengers will disembark via the walkway, go down an adjacent escalator or lift and proceed along the ground floor to the exit.

The terminal building is a braced steel frame, with the majority of the vertical bracing located around three internal lift and stair cores. Adding further rigidity to the frame, there is also tubular bracing in the roof, which assists in transmitting horizontal forces back to the vertically braced bays.

The roof also accommodates two plant rooms that bookend three 5m-diameter circular funnel-like roof lights that protrude upwards by a maximum of 1.5m. For ease of transportation, the roof lights were prefabricated in halves, which were brought to site and welded together before being installed. Predominantly fabricated from RHS sections, welded connections were deemed to be more aesthetically-pleasing as the roof lights will be a visual feature element of the completed project.

"The Isle of Man government wanted the building to signify the gateway to the island. While the building is relatively low profile in its context, the roof lights that puncture the roofline provide the terminal with a distinct form and nautical reference which travellers to and from the Isle of Man will be able to recognise instinctively as the ferry terminal," explains Manser Practice Architect Chris Coupland.

Adding some more Manx flavour to the terminal, hung from the inside of each of the glazed roof lights will be a triskelion, the Isle of Man's three-legged emblem.

Giving the terminal its desired light and airy environment, the first floor will feature full-height glazing, while the ground floor will incorporate zinc cladding.

"The choice of zinc on the ground floor matches the steel frame and is also in reference to the history of the Isle of Man, where zinc was traditionally mined. At one time, Laxey mine accounted for 20% of the British Isles production. It's also an extremely robust material more than suitable for the marine environment," explains Mr Coupland.

Steelwork erection for the terminal was completed in March and the three small structures will be installed by the end of June. By using a steel-framed option the project team say they have been able to keep elements, particularly the roof, as thin and slim as possible, while also incorporating 3.5m-wide cantilevering canopies around three elevations.

The riverside setting of the terminal has also meant the cantilevering elements, which are outside of the building envelope, are formed of galvanized steelwork, which is both resistant to the harsh environment and low maintenance as it requires no painting. ■

Whisky distillery reborn

The restored distillery will form an important canalside tourist attraction in Falkirk.

After a hiatus of nearly 30 years, steelwork is playing an important role in creating the facilities for production to restart at Falkirk's Rosebank Distillery.

Whisky production has in recent times taken on a new lease of life and is now considered as a tourist and visitor attraction at many of Scotland's leading distilleries.

Visitor centres, tasting rooms and an opportunity of a tour to see how the famous spirit is made, not only allows tourists a glimpse of an historic process, but also, and probably most importantly, encourages them to buy a bottle or two at the distillery shop.

An example of this trend can be found at the Rosebank Distillery in Falkirk, an historic site, originally built in the 1840s, but closed since 1993, which is being brought back to life with rebuilt tourist-friendly premises.

Set beside the Forth & Clyde canal, the distillery used this water source for its cooling process, a unique feature that will be resurrected once whisky production starts again at the end of the year.

However, before Ian Macleod Distillers, the new owners of the site, can begin producing their planned top-end whisky, a lot of work has to be completed.

Much of the original distillery has been demolished, as it was in too poor a condition to be restored and unsuitable for incorporation into the new design. These buildings have been replaced by new steel-framed structures, fronting the main road and creating a new entrance for the visitor centre and distillery.

The only exception along this elevation is a Nineteenth Century brick chimney, which is something of a local landmark and has been retained, with the new steel structure built around it.

It is a different story alongside the canal, where two Victorian buildings, a warehouse and the malt building, have been retained, refurbished and extended with new steel roofs and internal areas.

"To fulfil the architectural vision for the project, it was important to keep the canalside buildings," says ISG Project Manager Michael Russell.

"However, new steelwork areas have created the necessary open-plan production and visitor spaces and helped the design combine new and old structures."

In many areas throughout the scheme, steelwork connects to the retained buildings and even supports them in places. Meanwhile, in other areas, the new steel frame has to avoid existing structure.

Hescott Engineering Director Chris Scott says: "One of the biggest issues is that the new structure is positioned extremely close to the existing brick chimney, while we connect to the existing buildings in multiple locations across the site.

"Therefore, we initially carried out a laser scan of the site and integrated this into our model so that we could ensure that the new steel structure fitted within the confines of the plot and wrapped around existing structures without any clashes."

Measuring approximately 70m-long, the main new roadside steel structure is a two-storey building, topped with a feature saw-tooth roof, formed with a series of 4m × 15.5m welded cranked frames.

The main whisky distilling process will be undertaken within the entirety of the new steel-framed distillery building. The majority of the distillery equipment is housed at ground floor level. Steel mesh flooring at first floor level provides the distillery's key working area, a smart ventilation solution, while acting as part of tour route for visitors, with dedicated marked walkways.

Large openings in the mesh flooring will accommodate stills and other large items of equipment that need to protrude from the ground floor up through the first floor.

Numerous large items of equipment are needed at the distillery and main contractor ISG has been constructing and sequencing the works around an ongoing fit-out programme.

FACT FILE
Rosebank Distillery, Falkirk
Main client: **Ian Macleod Distillers**
Architect: **Michael Laird Architects**
Main contractor: **ISG**
Structural engineer: **Blyth & Blyth**
Steelwork contractor: **Hescott Engineering**
Steel tonnage: **400t**

Some of the largest items are three large copper stills, positioned in the new steel-framed structure and protruding through the largest openings in the first-floor mesh flooring.

Within the saw-tooth roof there are two demountable sections that initially allowed the stills (one demountable section for one still and the other for two slightly smaller vessels) to be installed into the completed steel frame. By simply unbolting the sections and removing them in one crane lift, they will also facilitate future maintenance work and the stills replacement every few years.

"Designing the feature roof would have been difficult in any other material other than steel, especially with the necessary demountable openings," explains Blyth & Blyth Engineer Liam Colquhoun.

"As well as creating the new column-free areas, the steel columns and beams, the connections and some bracing elements are left exposed throughout the distillery, highlighting and accentuating the industrial heritage of the site."

Overall, the site is wedge-shaped, with the new steel building meeting the largely retained structures at the southern end.

Connecting the two sides at the northern end and dissecting an inner courtyard is a wide, cobbled walkway known as 'the street'. This steel-framed structure will feature extensive plate glass windows to further highlight and show the new Rosebank whisky making process.

The new steelwork is stabilised by cross bracings and the composite action of the flooring which, as well as steel mesh for the visitor centre, also includes metal decking, precast planks and restored timber flooring in some areas.

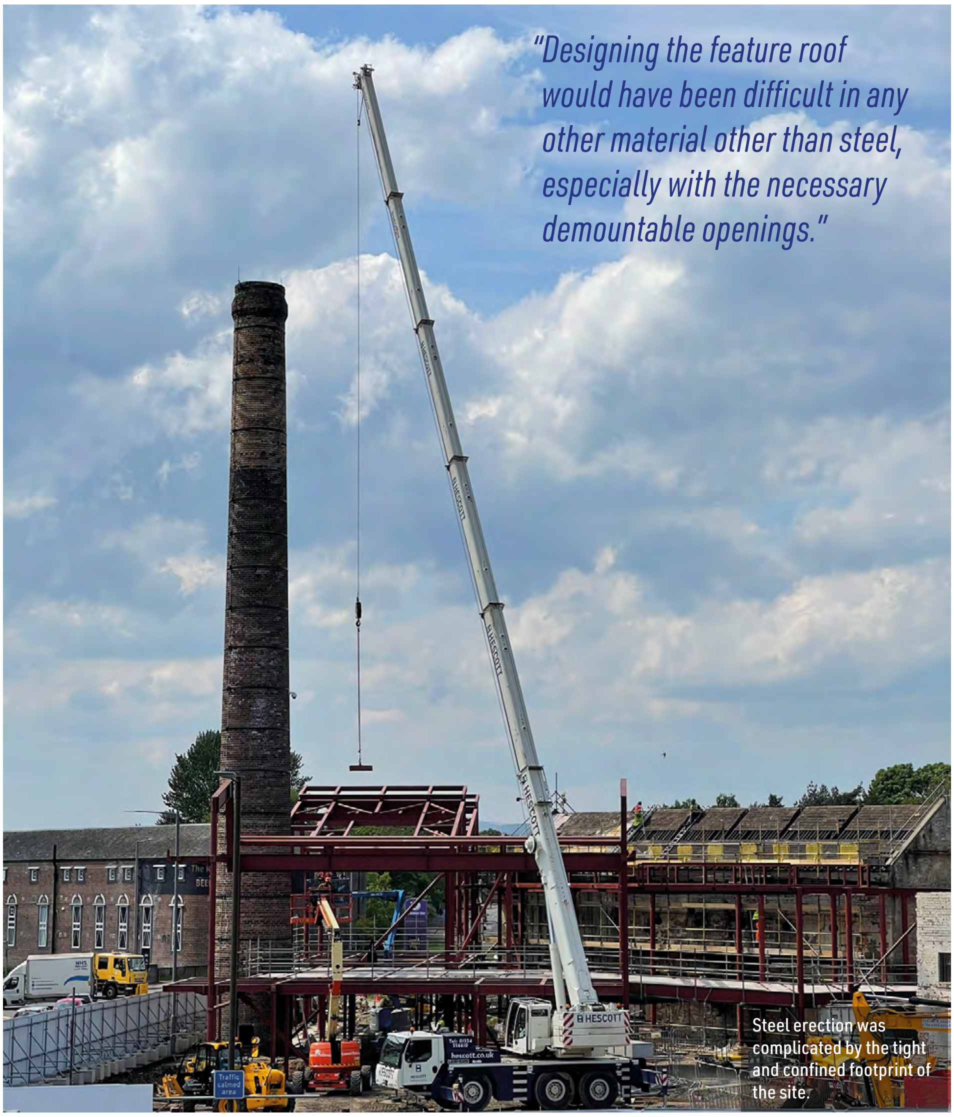
Within the retained structures, new steel roofs with long span rafters create the necessary column-free spaces for the maturation warehouse and the malt building. The latter has been extended northwards along the canalside elevation with new steelwork bays adjoining and connecting to the existing structure.

The rafters, do not gain any support from the retained brickwork, but are instead supported on a new steel frame positioned inside of the existing walls.

These buildings will also accommodate first-floor offices and more visitor areas, including tasting rooms. For those willing to pay more for their visitor experience, VIP tasting suites will be located in a restored lock keeper's cottage, which is positioned alongside the canal façade.

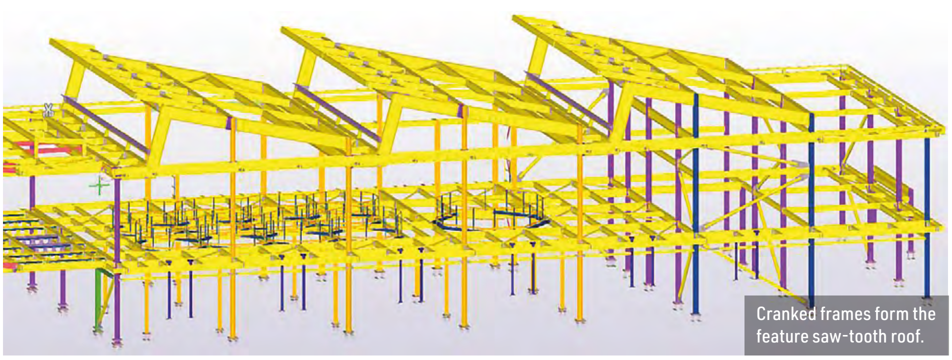
Summing up, Mr Russell says: "It is certainly a challenging project. We've got a main road in front, a canal at the back and a 160-year-old chimney right in the middle. And, we've got Historic Scotland involved because the buildings are listed. But it will all be worth it once whisky production starts up once again on this historic site later this year." ■

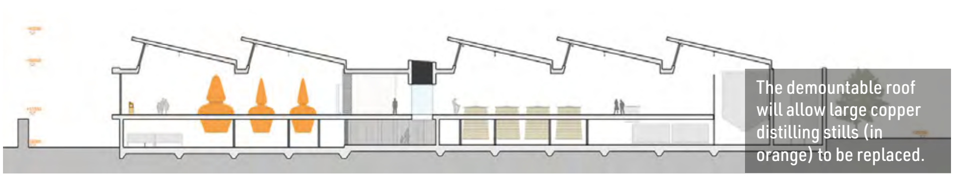
"Designing the feature roof would have been difficult in any other material other than steel, especially with the necessary demountable openings."



Steel erection was complicated by the tight and confined footprint of the site.


Construction work had to proceed around a retained historic chimney.

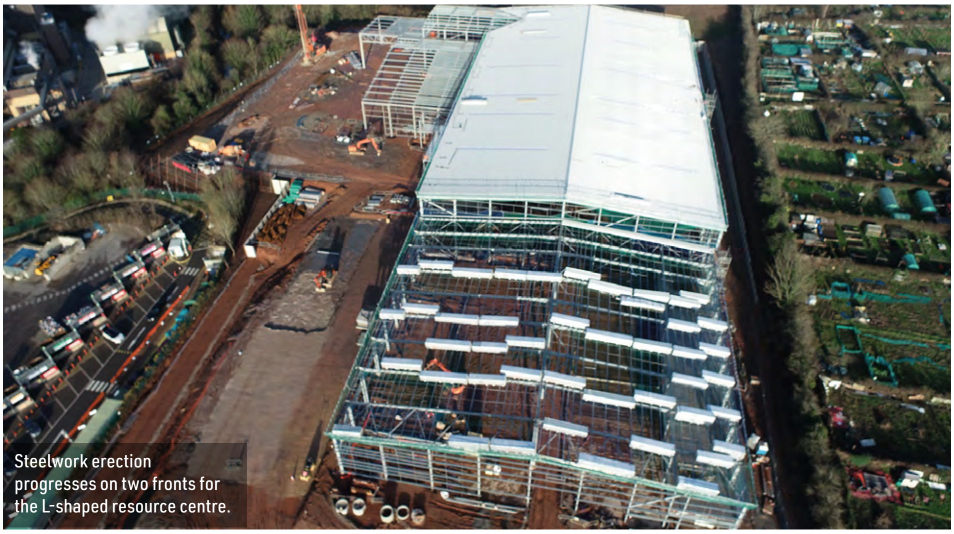

Cranked frames form the feature saw-tooth roof.


The demountable roof will allow large copper distilling stills (in orange) to be replaced.

FACT FILE
Sherbourne Resource Centre, Coventry
Main client: **Sherbourne Recycling**
Architect: **Cox Freeman**
Main contractor: **Clegg Group**
Structural engineer: **Alan Wood & Partners**
Steelwork contractor: **Caunton Engineering**
Steel tonnage: **577t**

Future-proofed recycling

Described as a facility of the future, the steel-framed Sherbourne Resource Centre will, on completion, offer a sustainable solution for recyclable household waste.



Steelwork erection progresses on two fronts for the L-shaped resource centre.

Expected to process up to 175,000 tonnes of household and commercial waste per year, the steel-framed Sherbourne Resource Centre in Coventry will be a state-of-the-art materials recycling facility (MRF), said to be the first to use Artificial Intelligence (AI).

"As the world embraces the need for investment in a sustainable future, our pioneering MRF is on track to achieve its goal to be fully operational by summer 2023.

"The ambitious venture will use AI at the core of its system production, resulting in real-time interconnectivity between the main sorting equipment. This will result in high rates of material purity from the widest range of material recycled, targeting UK markets," explains Sherbourne Recycling Business Manager Layla Shannon.

Housing the facility's all-important equipment, as well as the areas for receiving and sorting materials, are three large steel portal-framed structures.

Together they form an L-shape to suit the site and create a facility where the materials processing is laid out in a linear configuration. Each of the three portal frames is structurally-independent and

To allow easier truck movements in the completed scheme, a roof level truss allows the reception hall to have a large column-free space.

"Construction using a steel frame solution was ideal for this project as it allowed the flexibility required to combine the building structure requirements with the need to integrate a complex processing system."

Sherbourne Recycling

Facility owner Sherbourne Recycling was established in April 2021 for the purpose of operating and maintaining the new regional materials recycling facility on behalf of its eight local authority shareholders, made up of Coventry, North Warwickshire, Nuneaton and Bedworth, Rugby, Solihull, Stratford, Walsall and Warwick.

The partners are expected to collect around 120,000 tonnes of dry mixed recycling in year one of operations, with additional capacity expected to be filled through third party contracts, as well as potentially other local authorities across the Midlands. ■

A two-storey office block is attached to one elevation of the sorting hall.

at the two points were buildings meet, there is a dividing row of double columns, that accommodate doorways and openings for equipment such as conveyor belts.

Working on a design and build contract for the project's structural steelwork, Caunton Engineering has erected 577t of steel.

"Starting at the north of the site, then working southwards and around the ongoing groundworks and piling, the steelwork erection programme was completed sequentially, one structure after another," says Caunton Engineering Contract Manager Richard Patterson.

Prior to any steelwork arriving on site, main contractor Clegg Group started work on the former allotment site in May 2021. As well as installing piled foundations, in readiness for the steel frames, Clegg also undertook a large-scale earthmoving programme in order to create a flat plateau for the facility, on the previously sloping land.

During and after the earthmoving operation, all excavated rock was crushed, graded and reused on the site.

Clegg Group Business Development Director John Moxon says: "We have worked closely with the Sherbourne project team, our designers and key supply chain partners to ensure we all have a clear understanding of the project requirements.

"There have been a number of challenges, but we have worked through these together and progress is now rapid with the majority of the steel structures now in place. Construction using a steel frame solution was ideal for this project as it allowed the flexibility required to combine the building structure requirements with the need to integrate a complex processing system."

Forming one end of the L-shape is the reception hall, where trucks will deliver the household materials for sorting and processing. Large hoppers will be positioned within this portal frame, while the structure also has to be large enough for trucks to enter and turn without any hindrance. To this end, the building, like its two neighbours, has minimal internal columns.

The reception hall, which measures 60m-long x 55m-wide, is an asymmetric portal frame with two unequal spans of 18m and 37m. The highest point of this structure is the 15m-high ridge, which is positioned within the widest span as the single row of internal columns are offset.

This was the first structure to be erected, although due to the ongoing groundworks and piling, the smaller span was not initially installed until later in the programme.

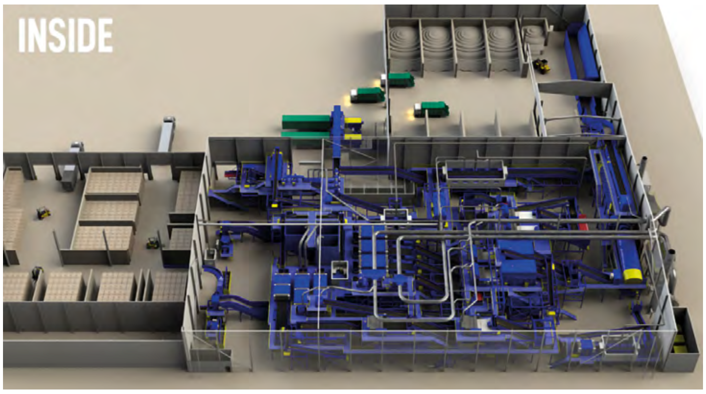
To allow some extra space for truck movements, two internal columns have been omitted and replaced with a truss measuring 20m-long × 2.5m-deep and weighing 4.2t.

Supported by two internal columns at either end and positioned at roof level, the truss was brought to site as one fully welded piece, ready to be lifted into position.

Controlling deflections within this large steel frame are diagonal bracings, formed with circular hollow sections (CHS) in a lattice configuration. Positioned in the roof above the rafters, the bracings are installed from gable end to gable end.

When the MRF is operational, materials will be transferred between the reception hall and the adjacent process hall via conveyor belt. The two-span portal-framed process hall measures 99m-long × 57m-wide and is 17m-high to the apex.

Replacing approximately 50% of this structure's central row of internal columns is a 52m-long × 3.3m-deep high-level truss. Supported at either ▸20



▸19 end by a single column, this truss also creates a large column-free area.

Brought to site in four welded sections, the truss was assembled on site into a complete 27t section, before being erected by two cranes. Similar in design to the reception hall, this structure also features roof bracings fabricated from CHS members.

The third and most southerly portal frame is the outfeed hall, where the processed material will be separated into various bunkers, in readiness for recycling. This building measures 56m-long × 49m-wide and is 12m-high to the apex.

The outfeed hall is divided by a central row of internal columns, creating two 24.5m-long spans. In a similar method as the other two structures, the roof rafters were brought to site in two sections per span, bolted into a complete piece onsite before being lifted into place.

Within the eastern elevation of the outfeed hall, there is a two-storey 8.5m-wide office block. Constructed in a traditional beam and column method, with no internal columns, the upper floor of the office block is formed with a composite metal decking solution.

The first pieces of equipment are due to be installed within the steel portal frames later this year in readiness for commissioning. ■

More complicated than it looks

The Sherbourne Resource Centre may look ordinary to the casual observer, but a closer look reveals plenty of engineering challenges requiring thoughtful design. David Brown of the SCI comments on the structural solution.

Within the Resource Centre, the Process Hall is 100 m long and initially gives the appearance of a conventional 'hit and miss' portal. The columns support the apex, rather than the usual valley arrangement, and have a longitudinal member supporting the apex of the 'miss' frames. 'Hit and miss' frames always need careful consideration. Firstly, the transverse stability of the structure is affected due to the different structural arrangement on every other bay. Secondly, the two different frame arrangements would naturally take up a different deflected form, which must be prevented to protect the cladding. The solution adopted at Sherborne was to provide bracing in the plane of the roof between every bay to force the frames to deflect identically. SCI publication P399 includes a procedure for assessing the 'hit' and 'miss' frames and iteration to determine the lateral forces. A 3d analysis is an alternative approach.

The Resource Centre is however more complicated that an orthodox 'hit and miss' frame – at one end of the structure all the 'miss' columns are entirely removed and the frames supported on a 52 m-long truss. Under normal loading, the top chord of the truss is in compression and needs lateral restraint – which cannot be provided by the relatively flexible portal frames in the orthogonal direction. The solution here was to provide a truss in the plane of the roof over the full 100 m length of the building. This lateral truss provides restraint to the 52 m length supporting the portal rafters and provides the essential bracing between the remaining 'hit and miss' frames. Vertical bracing in the gables takes the forces in the lateral truss to ground.

Load reversal due to wind uplift puts the lower chord in compression – restraint is provided by diagonal members from the bottom chord to the portal rafters, which are themselves connected into the lateral truss.

The portal rafters are continuous through the 'hit' apex columns, through the longitudinal apex beam, or through the 52 m-long truss, depending on their location. The 52 m-long truss was detailed with vertical internals on the frame locations, which were fabricated such that the connection zone was the same as a 'hit' column profile, meaning the rafters were identical.

One further challenge was the erection method for the 52 m-long truss. This was connected on the ground and then held aloft by two cranes whist certain rafters (and purlins) were erected using a third crane. This temporary case was carefully analysed considering the loading and fixity of the frame at that stage.

The Sherbourne Resource Centre is a good example of something which may look to be a straightforward and utility structure, when in fact the truth is the opposite. There were plenty of design challenges to be addressed resulting in a structure that demonstrates thoughtful best practice. ■

Trusses create vital column-free capacity

Providing end-user KLM UK Engineering with additional aircraft maintenance and repair capacity, a new £7M steel-framed hangar has landed at Norwich Airport.

With a catchment area that extends beyond the boundaries of East Anglia, Norwich Airport serves more than 500,000 domestic and international passengers every year.

It is the only passenger airport in the region; the next closest being London Stansted, which is more than 80 miles away.

Like many airports, Norwich was once a military establishment; RAF Horsham St Faith during the Second World War in this case.

For the last three years of the War, the United States Army Air Forces (USAAF) used the facility, and after hostilities the Royal Air Force remained on site until 1967.

In the following years, it was gradually converted into a passenger airport, with a main terminal opening in 1988. Today, many of the former military buildings remain, although they have been refurbished for a variety of new purposes. Five pre-war hangars are also still in existence, one of which has been converted into an aviation academy (see *NSC* January 2017).

The latest development at Norwich Airport consists of a new £7M scheme for end-user KLM. The project has created a 5,016m² Maintenance Repair Overhaul (MRO) hangar – large enough for two A320 aircraft – with an adjacent 1,400m² workshop.

Interestingly, Netherlands-based KLM is a major operator at the airport and its service to Amsterdam is the busiest route to and from Norwich.

The new MRO hangar is said to provide significant new capacity for KLM at Norwich Airport to provide high-quality maintenance, repair and overhaul services for its aircraft.

As with all aircraft hangars, this project was built around the need for large column-free spans, a requirement best served with a steel-framed solution.

A specialist contractor in this field of construction for more than 100 years, REIDsteel designed, fabricated and erected the steel frame for this project, as well as undertaking the installation of cladding, glazing and internal ladders.

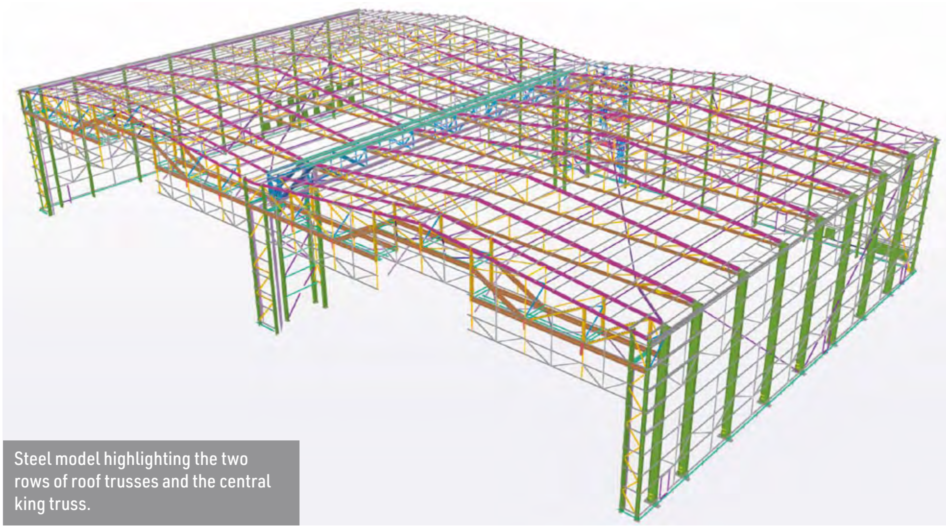
This was not the first time the company had worked at Norwich Airport, as it has erected a number of other steel-framed structures on the site. Stretching back over 30 years, it previously worked on a customs bonded warehouse with an arch span portal frame design in 1989, a cargo centre in 1998 and the refurbishment and extension of a hangar in 2006.

MJS Projects Director David Henry says: “The

FACT FILE
Norwich Airport hangar
Main client: **Norwich Airport**
Architect: **Stephen George & Partners**
Main contractor: **MJS Projects**
Design and build steelwork contractor: **REIDsteel**
Steel tonnage: **340t**

A central king truss is supported by two lattice columns.

Large column-free spaces are vital for hangars and can be efficiently formed using a steel-framed solution.



Steel model highlighting the two rows of roof trusses and the central king truss.

Reidsteel pre-construction team were very attentive and came to meet us to discuss the project in detail. This gave us confidence in their knowledge and expertise and they gave us invaluable information on construction method and programme options."

REIDsteel brought its value engineering expertise to rationalise the scheme's structural steel design, which led to savings in both time and money.

The hangar is 16m-high to the eaves, measures 91m-wide × 55m-deep, and consists of two equal spans of 45.5m.

Creating the all-important internal column-free space is a central spine 'King' truss, supported at either end of its 55m-length by two lattice columns. The spine truss supports a series of roof trusses on either side, which are also supported on perimeter columns.

The spine truss, along with its two supporting columns, was among the first steelwork elements to be erected. The truss weighs 36t, was brought to site in three welded sections and assembled on the ground, before being tandem lifted into place by two 250t-capacity mobile cranes.

Once this central element was in place, the two rows of 45.5m-long roof trusses were lifted into place sequentially, between their supporting perimeter columns and the king truss.

"The roof trusses weigh 6.5t each and were delivered as their component pieces," explains REIDsteel Project Manager Zacc Richards. "The trusses were assembled on temporary trestles, before they were individually installed with a series of two-crane tandem lifts."

All of the hangar's roof trusses are the same with the exception of the two that support the pair of megadoors, which are positioned at one end of the building.

These trusses are deeper than the others, at 4.5m, and were brought to site piece-small. All of their bolted connections were completed, then the 15t elements were lifted into place.

Stabilising this large open-plan structure is a system that includes V-shaped SHS steel bracing along each of the 55m-long elevations, and SHS bracings in the roof that form a X-shape on plan across both spans.

All of the bracings take the structure's loadings to the four corners of the hangar, with the load path then continuing into the supporting pad foundations at the bottom of the "V's".

Sat adjacent to the hangar, the project also includes a 40m × 36m portal-framed workshop building. This steel-framed structure is 7.5m-high to the eaves and includes a mezzanine floor that spans over approximately one-third of the internal floor space.

As well as choosing structural steelwork for its long span attributes, the material is also a favoured framing solution because of its speed of construction.

Summing up, Mr Henry says: "Site works were organised, safe and delivered to programme and to a high standard. Even as the pandemic took hold, Reidsteel spoke with us clearly and sensibly and we agreed a safe and suitable way forward, which we could pass on and agree with our client."

The hangar and workshop are now fully functioning and important additions to Norwich Airport. ■

The use of semi-continuous joints to reduce steel weight and cost

Graham Couchman of the SCI revisits a publication from 1997 which, as we become increasingly concerned with embodied carbon, and therefore efficient use of materials, may be more relevant now than it has ever been. The design guidance offers the potential to significantly decrease beam weights, with no increases in joint complexity and cost, and only marginal increases in frame analysis and design complexity.

Introduction

Has the time finally come for semi-continuous frames? BCSA's *UK structural steelwork: 2050 decarbonisation roadmap*[1], produced with input from SCI and launched at the end of 2021, identified 'design efficiency' as one of the key ways for steel construction to achieve its targets. Design's estimated potential to contribute 18% of the 'change' needed is clearly very significant, and much of that potential is available to be exploited right now. SCI's guide to *Semi-continuous Braced Frames* (P183)[2] was published in 1997, and remains entirely valid. It was written at a time when SCI was focused primarily on 'structural engineering', and had only one or two experts working on 'sustainability'. Today these previously separate disciplines have effectively merged as far as much of the guidance and advice SCI offers is concerned, with a major focus of the steelwork industry in the UK now being 'sustainable structural engineering'.

Reducing the weight of steel by 18% may sound a lot, but Prof Julian Allwood and his team at the University of Cambridge have published a number of papers[3], suggesting that UK steel construction designers use nearly twice as much steel as necessary in order to satisfy design codes and regulations. Clearly this number depends on the building type, and would not apply to single storey industrial buildings. Much overdesign is down to non-technical issues, including low design fees, and the order of the design and procurement process (which means some loads are unknown at the time of design so blanket values are used, and designers are tempted to include some 'bunce' to accommodate subsequent changes of specification without needing to re-design).

There are two obvious results of low design fees, which are paid without recognising the correlation between the time spent on design and the 'quality' of the outcome. These results are, designing the most heavily loaded element of its type (e.g. a beam in a floor zone) and using the same size for other elements, and making the assumption that the joints are nominally-pinned. The latter choice makes the frame design simple in two senses of the word – easy to do (because there is no stiffness continuity between members), and 'simple' as such frames are known. Simple design is also chosen because it is recognised that much of the fabrication cost of a frame is associated with the joints, so complexities such as stiffeners and haunches are best avoided. The common split of responsibility between design of the beams and columns, and design of the joints, is also unhelpful if trying to develop a solution that optimises the member and joint 'sizes' and recognises the interaction between them . Assumed zero moments in the joints of a 'simple frame' mean that sagging moments in the simply-supported beams are maximised for a given level of loading. Rigid joints, used to produce continuous construction, are not used in braced frames unless exceptional circumstances dictate.

Semi-continuity offers many of the benefits of continuity, in terms of reducing beam sagging moments, deflections and therefore sizes, whilst retaining most/all of the benefits of simple construction in terms of fabrication cost and erection ease. This is because many so-called pinned joints, perhaps with some 'thickening' of components, do in fact offer reasonable stiffness and strength. Stiffeners and haunches are not needed to achieve very beneficial stiffness and strength – semi-rigidity and partial strength respectively, to use terminology from EN 1993-1-8. Figure 1 shows a schematic representation of the moment-rotation behaviour of a semi-continuous joint, illustrating the characteristics of stiffness, strength and (of equal importance, but often forgotten and very difficult to accurately predict) rotation capacity. The stiffness reduces from an initial elastic value, through ever decreasing secant values as the applied moment increases and the joint moves from elastic to elasto-plastic to plastic behaviour.

▸26

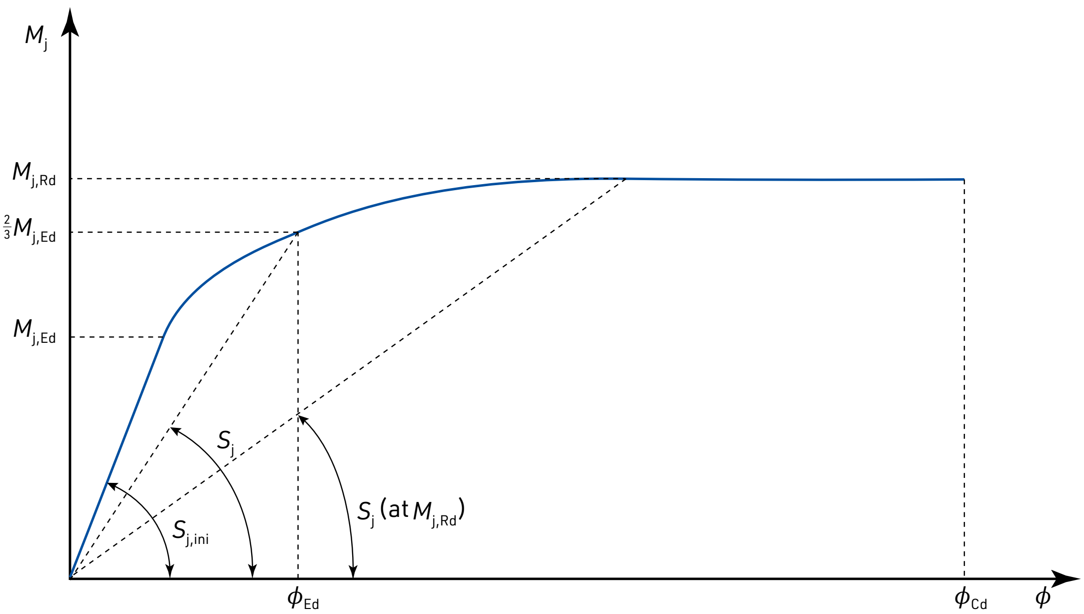


Figure 1.
Moment rotation behaviour of a semi-continuous joint

▸24 P183 describes how to apply semi-continuous design to braced frames. The key steps are summarised below. It is based on the premise that standard joints will be used, but 25 years after it was published we should be able to offer greater design/detailing freedom.

SCI has previously published guidance on semi-continuous unbraced frames[4], based on the so-called wind-moment method. Some readers may know that this is a very opaque way of designing frames, where assumptions are made that implicitly 'give the right answer', but clearly don't represent what happens in reality. The wind-moment method was widely used in the days of 'hand calculations', and may still have a place as even today explicit design of semi-continuous unbraced frames is extremely complex (because of the load-unload behaviour of the joints under load reversal, which results in varying stiffnesses and 'shakedown'). Care should be taken to ensure that a given design falls within the scope of application of the wind-moment method, with particular attention drawn to the need for fixed base columns.

How to do it?

P183 was written at a time when it was envisaged hand analysis and design would be adopted. Although today one would imagine that software might well be used for semi-continuous frame design, P183 (and the notes below) contains much useful information and guidance. Its Section 6 describes the design procedure in only two pages, with the stages summarised below. These are presented as a 'teaser' to show designers the ease and potential benefits, and encourage them to study the complete guidance.

Scheme design

Select column sizes to resist axial load alone in an overall buckling check. The utilisation of perimeter columns should be limited to 0.8, to allow some reserve for applied moment. The utilisation of internal columns may approach 1.0 (a lower value should be used for columns in an unbalanced situation, for which guidance is also given in P183).

Select Class 1 or 2 beam sections, based on the following criteria and the assumption that the beams will be restrained against failure in lateral torsional buckling:

- Internal span $M_{pl,Rd} \approx 0.70\, M_{Ed}$
- External span $M_{pl,Rd} \approx 0.80\, M_{Ed}$

Where:

$M_{pl,Rd}$ = moment resistance of the beam

M_{Ed} = free bending moment at ULS

Final design

Joints

Select standard joints from the design tables provided in P183. Note that these are the same as the so-called wind-moment joints specified in the 'Green Book'[5], and, although this is a BS 5950 orientated guide, the resistances are based on the EN 1993-1-8 component method and are 'Eurocode compatible'. The minimum joint moment resistance must satisfy the shortfall between the maximum applied moment and the moment resistance of the beam. Doing so means that no further check of the beams is required for the ULS. This highlights the interdependence of joint and member design, both of which should be carried out by the same 'person' for a semi-continuous frame.

The joint moment resistance should not exceed 50% (i.e. 50% partial strength) of the beam resistance for a joint to an internal column. The moment resistance of a joint to an external column should be approximately 20% of the beam resistance.

Check the joint shear resistance (using the design tables for standard joints), and add 'shear bolts' if necessary.

Beams

Calculate beam deflections under imposed (SLS) loading, using appropriate formulae and deflection coefficients as given below. Beams should be thought of as being rotationally restrained at the supports by springs. The spring stiffness represents the stiffness of the joint itself, plus that of the adjoining structure. Because of this stiffness, beam behaviour lies between 'built-in' and 'simply supported'.

The graph shown in Figure 2 is taken from P183 and shows that not a lot of support rotational stiffness is needed to significantly reduce the beam deflections.

For the analysis of orthodox frames (as defined in P183), there is no need for the designer to determine an effective support stiffness provided the standard joints are used. The formulae below may be used for beams subject to uniformly distributed loading (other load types are considered in P183). The coefficients used in these equations are a conservative approximation, but P183 includes rules that allow stiffness of a particular situation to be taken into account explicitly for more accurate results (P183 Appendix B.2 states how to combine joint, column and beam stiffnesses to determine the equivalent stiffness of the rotational support).

$$\delta_{imposed} = \frac{\beta}{384}\frac{wL^4}{EI}$$

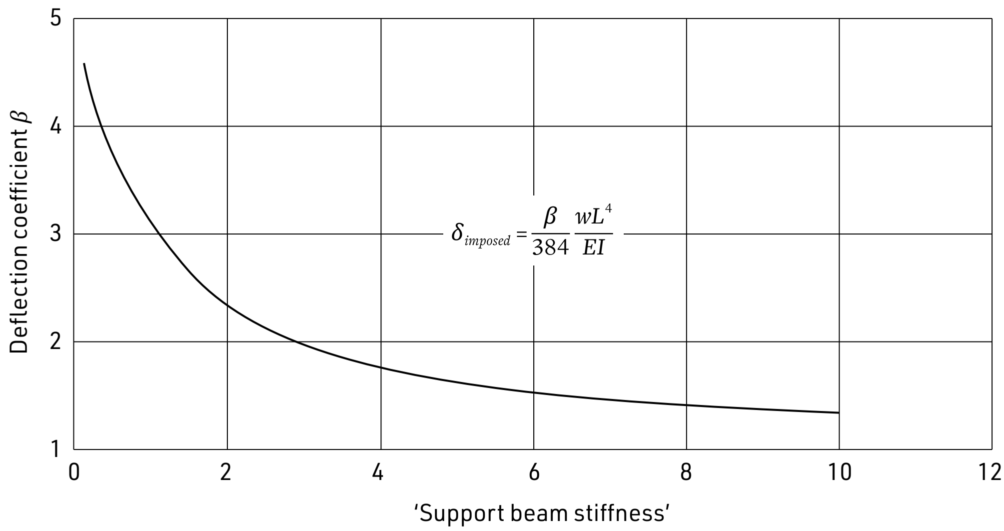


Figure 2: Beam deflection as a function of support rotational stiffness (internal span subject to UDL)

For an internal span:

with joints having a partial strength in excess of 45%, $\beta = 3.0$

with joints having a partial strength less than 45%, $\beta = 3.5$

For an external span:

with joints having a partial strength in excess of 45%, $\beta = 3.5$

with joints having a partial strength less than 45%, $\beta = 4.0$

The relevance of using standard joints to justify the use of the relationships above is that they have a known (from testing) relationship between stiffness and strength, so can be chosen based solely on the latter. Guidance is given in P183 that would enable other joints to be used with stiffness and strength considered explicitly. The third key characteristic of a joint should not be forgotten even though rarely quantified – namely rotation capacity. Because the joints are partial strength they will normally be the location of the first plastic hinges, and so must be able to rotate sufficiently. The detailing of the standard joints means they are known, through testing, to be able to do this.

It is worth commenting on the UK National Annex to EN 1993-1-8[6], and what this means for the use of non-standard joints. Whilst explicitly allowing the use of semi-continuous design, it states that 'until experience is gained with the numerical method of calculating rotational stiffness given in BS EN 1993-1-8, semi-continuous elastic design should only be used … where supported by test evidence … (or experience)'. Although this was published some time ago, it is doubtful that much experience has been gained. But of course the procedure described in P183, and here, does not use elastic design for ULS – the joints are behaving plastically well before collapse so their initial stiffness is irrelevant. Some inaccuracy when calculating deflections is part of structural engineering, not just limited to semi-continuous design. Indeed assuming joints are pinned, i.e. have zero stiffness, will always lead to an overestimation of deflections, with considerably greater inaccuracy than one would expect with semi-continuous joints designed using EN 1993-1-8!

Once deflections are determined, they are checked against limits as usual. Dynamic checks should also be performed (noting that whether joints are pinned, semi-continuous or continuous they behave as if they were rigid when subject to dynamic loading).

Columns

Check internal columns for overall buckling under the applied axial load in combination with any moment about the major axis resulting from unequal ▸28

▸27 joint strengths, and any unbalanced minor axis moments. Minor axis moments should be calculated and distributed as in simple design (there are no standard details for minor-axis semi-continuous joints, though they might be envisaged), assuming eccentric beam reactions. The internal columns should also be checked for local capacity, considering axial loads and moments under pattern loading. Simplified procedures are given in P183.

Check perimeter columns for the applied axial load in combination with any major or minor axis moments. Both overall buckling and local capacity checks are required.

Check that the column sizes identified in the final design are compatible with the joint details, preferably without the need for column stiffening.

Details

Design the column bases, column splices, and the frame bracing systems as in 'simple construction'. The detailing of bases and splices, which may be pinned or chosen to provide moment continuity, must be properly reflected in the frame analysis and design assumptions. Care should be taken if semi-continuous joints are used as part of the bracing system, because the behaviour of the joints may be adversely affected by either the presence of additional axial or shear loads in the beams, or detailing to accommodate the bracing members.

What now and next?

A simple illustration of the benefits to be had from using semi-continuous design, rather than simple design, can be gained by considering the reduction in beam size that could be possible due to the use of the β values given above for deflections (as β goes down, the second moment of area can follow it and still result in the same deflection). A 457×152×82 UB has a second moment of area of 36,588 cm^4. If used in a frame with semi-continuity such that the β value dropped from five to three, this beam could be replaced by a 406×178×60 (second moment of area 21,596cm^4). So a saving of 22 kg/m (almost 27%) for this simple comparison assuming deflection was critical. If we use beam weight as a simple representation of embodied carbon for the two cases, we can see how semi-continuous design could be highly relevant for future designs.

In 2022 SCI and BCSA will be working together to produce guidance on 'design for sustainable steel construction'. This will include a more detailed review of the semi-continuous frame design principles and rules. Unlike 25 years ago, designers today can use tools to determine joint strength, stiffness and rotation capacity, although levels of accuracy (of the last two) may be open to some question. SCI will be developing an easy-to-use tool, using Trimble's TEDDs platform, in 2022. This will allow key characteristics of 'typical' types of joint to be determined using the well-accepted EN 1993-1-8 component method. As TEDDs is part of the Trimble family this may also allow integration with their frame analysis and design software, which will really make semi-continuous design simple. ■

References

1. *UK structural steelwork: 2050 decarbonisation roadmap*, BCSA, 2021
2. *Design of semi-continuous braced frames*, P183, SCI, 1997
3. Dunant, C., Drewniok, M., Eleftheriadis, S., Cullen, J., & Allwood, J. M. (2018). Regularity and optimisation practice in steel structural frames in real design cases. *Resources, Conservation and Recycling*, 134 294-302
4. *Wind-moment design of low-rise frames*, P263, SCI, 1999
5. *Joints in steel construction – moment connections*, P207, SCI, 1995
6. *UK National Annex to Eurocode 3: Design of steel structures. Design of joints*, BSI, 2013

New and revised codes and standards

From BSI Updates March 2022

BS EN PUBLICATIONS

BS EN ISO 3382-3:2022
Acoustics. Measurement of room acoustic parameters. Open-plan offices
supersedes BS EN ISO 3382-3:2012

PUBLICLY AVAILABLE SPECIFICATIONS

PAS 9980:2022 – Hardcopy
Fire risk appraisal of external wall construction and cladding of existing blocks of flats. Code of practice
no current standard is superseded

UPDATED BRITISH STANDARDS

PD 6694-1:2011+A1:2020
Recommendations for the design of structures subject to traffic loading to BS EN 1997-1:2004+A1:2013
Corrigendum, January 2022; Amendment, May 2020

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS EN 14019:2016
Curtain Walling. Impact resistance. Performance requirements

PD ISO/TR 16732-2:2012
Fire Safety Engineering. Fire risk assessment. Example of an office building

PD ISO/TR 16732-3:2013
Fire safety engineering. Fire risk assessment. Example of an industrial property

PD ISO/TR 24679-3:2015
Fire safety engineering. Performance of structure in fire. Example of an open car park

NEW WORK STARTED

EN 13116
Curtain walling. Resistance to wind load. Performance requirements
will supersede None

ISO 15513
Cranes. Competency requirements for crane drivers (operators), slingers, signallers and assessors
will supersede BS ISO 15513:2000

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

22/30441528 DC
BS EN 12153 Curtain walling. Air permeability. Test method
Comments for the above document were required by 25 March, 2022

22/30437730 DC
BS EN 10248-1 Hot-rolled steel sheet piles. Technical delivery conditions
Comments for the above document were required by 5 April, 2022

22/30443554 DC
BS EN 12354-5 Building acoustics. Estimation of acoustic performance of building from the performance of elements. Sounds levels due to the service equipment
Comments for the above document were required by 5 April, 2022

AD 481: Composite beams with deep composite slabs

It has come to SCI's attention that composite slabs with an overall depth/thickness in the range of 200 mm to 250 mm are becoming increasingly common, particularly in cases where significant concentrated loads are involved, or where serviceability requirements (e.g. floor vibration) or other criteria (e.g. acoustic performance) that are specific to a particular project need to be satisfied. This has reportedly caused problems from a composite beam design perspective, and designers are often finding it difficult to satisfy the minimum degree of shear connection requirements. This is because the scope of SCI P405[1] limits the overall depth of a composite slab to 180 mm and requires that the depth above the profile does not exceed 100 mm, therefore not allowing its use for deeper slabs. The question then is whether the above limits within P405 could be relaxed (or removed), and whether there are any other reasons to limit the depth of a composite slab.

SCI P405 and minimum degree of shear connection requirements

The scope of P405, and more specifically the slab depth limitation, was based on the range of configurations investigated (geometries used in the finite element analyses). Also, it was based on what we thought (at the time) was the range that covered most practical cases. Since then, the SCI has carried out additional investigations on simply supported composite beams with deep composite slabs. The effect of the slab depth in terms of the minimum degree of shear connection requirements is explained in the following paragraphs.

By increasing the depth of the composite slab, the bending resistance of the composite beam also increases. This increase is relatively modest, particularly when the degree of shear connection is low (i.e. cases that would benefit more from P405), but it can become more significant for higher degrees of shear connection that allow greater force to be transferred to the concrete flange. An increase of the bending resistance suggests that the minimum degree of shear connection requirement should also be increased, at least for a beam that is going to be highly utilised in bending. On the other hand, any additional slab depth means more load is applied at the construction stage (due to the additional weight of concrete), which can be beneficial in terms of the shear connection requirements for beams constructed unpropped (for which there is no demand on the shear connection as a result of concrete self-weight).

To demonstrate the above, the example of Figure 1 is considered. For the composite sections shown, finite element analyses were carried out and the results are presented in Table 1 in terms of slip at the reference value of $0.95M_{pl}$, where M_{pl} is the plastic resistance moment of the composite section. This is the level of loading that was used for the calibration of the minimum degree of shear connection rules in both BS EN 1994-1-1[2] and SCI P405.

The degree of shear connection provided in the example of Figure 1 is 0.33, compared to 0.61 required by BS EN 1994-1-1 and 0.25 (or 0.28 for propped) required by SCI P405 (the slip capacity is limited to 10 mm for this case with transverse trapezoidal decking). As shown in Table 1, although this is sufficient for both beams and the assumed slip capacity of the studs is not exceeded, the slip is higher for the case with the 250 mm deep slab when the beam is propped at construction stage (which suggests that the required $\eta = 0.28$ by P405 may not be, quite, sufficient in this case). However, when the beams are constructed unpropped, the slip is actually lower for the beam with the 250 mm slab than that for the 160 mm slab. As explained, this can be attributed to the higher proportion of load that is applied at the construction stage.

Table 1: Maximum values of slip at $0.95M_{pl}$ for the configurations of Figure 1

Slab depth	Propped	Unpropped
160 mm	8.5 mm	6.3 mm
250 mm	9.2 mm	5.0 mm

Figure 1
Composite beam with
(a) 160 mm composite slab and
(b) 250 mm composite slab

Configuration details:

12m span beam

3m effective width

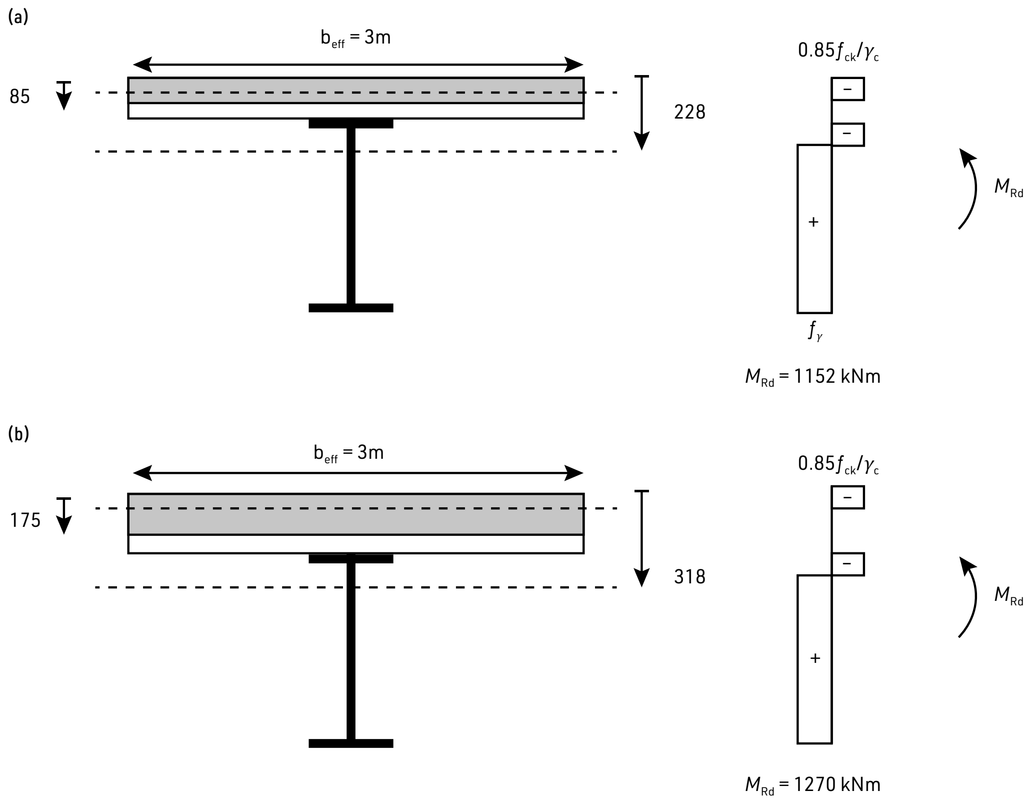
Fabricated steel section (IPE 500 equivalent dimensions)

S355 steel

C30/37 concrete

Transverse trapezoidal deck (60 mm deep with 15 mm stiffener at the top)

Degree of shear connection $\eta = 0.33$



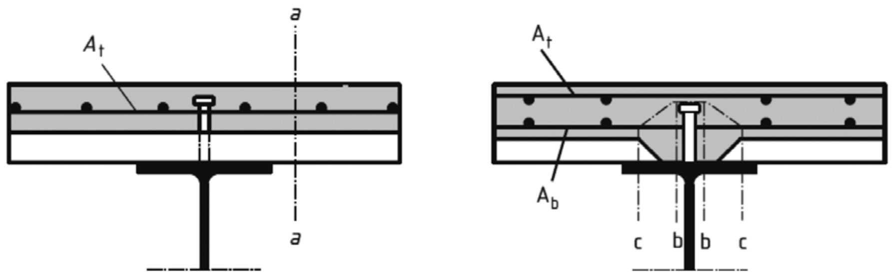


Figure 2 Shear surfaces considered in BS EN 1994-1-1 for the verification of longitudinal shear

Plastic vs elastoplastic stress analysis of cross-section

The bending resistance of composite beams is normally determined from plastic analysis of the cross-section. This assumes that the effective areas of the steel section and the concrete flange can reach their design strengths before the concrete begins to crush. Depending on the cross-section considered, this assumption may become invalid. The current version of BS EN 1994-1-1 accounts for this effect in 6.2.1.2(2), through the introduction of a reduction factor β applied to the plastic resistance moment for steel grades greater than S355 (i.e. S420 and S460). This is because for such grades greater strain, and therefore more cross-section curvature, is needed to yield the steel. However, another aspect of the cross-section should also be considered; when the slab is deeper, it will experience greater compressive strain in the upper fibres of concrete for a given curvature. This will be reflected in the revision to BS EN 1994-1-1, with anticipated β values that also take into account the depth of the plastic neutral axis in the cross-section (β values will also be included for other steel grades, not just S420 and S460). In the meantime, care should be taken when assuming full plastic resistance for slabs that are atypically deep, although when the degree of shear connection is low the interface slip will reduce the compressive strains in the concrete.

Resistance and ductility of headed studs in composite slabs

BS EN 1994-1-1, 6.6.5.1 requires that the underside of a headed stud should extend at least 30 mm (clear distance) from the 'bottom' reinforcement. This statement clearly refers to slabs with two reinforcement layers, and is directly linked to the requirement for studs to resist slab-steel beam separation (i.e. studs also subjected to pull-out forces).

Common practice in UK construction is to provide a single layer of mesh reinforcement, which is often placed near the top of the slab at nominal cover to also control cracking and ensure an adequate performance in the event of fire. NCCI PN001a[3] concluded that the detailing requirement of BS EN 1994-1-1, 6.6.5.1 does not need to be satisfied. This was based on the results of push-out tests, which showed that adequate resistance and ductility could also be achieved with the single layer mesh at nominal cover. The majority of these tests was on composite slabs with either 60 mm or 80 mm deep profiles, where the total slab depth did not exceed 160 mm, and the mesh was at the level of the stud head or slightly above (about 10 mm to 15 mm).

Therefore, the effect of having a deeper slab with a single layer mesh at nominal cover, i.e. at a greater distance above the head of the stud than investigated in the push-out tests, is not adequately known or understood. Smith and Couchman[4] reported two series of push-out tests where the slab was 225 mm deep. Six tests were carried out (three per series). The specimens for the first series included a single stud per trough, while for the second series a pair of studs was used. The sheeting used was 60 mm deep, while the single layer of mesh reinforcement was placed at nominal cover, i.e. 25 mm from the top of the slab. Other test series were also included in the same test programme, where the slab depth was 140 mm. For the latter, the position of the mesh was either at 25 mm from the top or the slab or it was simply resting on the steel profile. The testing arrangement used, included the application of lateral load during the test. Comparison between the results for the deep and the shallow slab specimens did not reveal any influence of the slab depth on the stud shear resistance. There was actually a small increase of the resistance in the case of the deep slab specimens, which was significantly more pronounced for pairs of studs. However, these results were inconclusive in terms of the role of the slab depth.

Longitudinal shear resistance of beams

A composite beam must be verified for longitudinal shear, and adequate transverse reinforcement must be provided according to BS EN 1994-1-1, 6.6.6.4. The verification needs to be carried out considering different potential shear (failure) surfaces, as shown in Figure 6.16 of the Code, which is partly reproduced in Figure 2.

For the case shown on the right of Figure 2 where the sheeting is discontinuous over the beam (and the ends are not connected to the beam with through-deck welded studs), and also in the case where the sheeting is orientated parallel to the beam, the sheeting cannot be assumed to be effective against longitudinal shear. Therefore, mesh reinforcement should be placed below the head of the stud in order to be able to assume that it contributes to the longitudinal shear resistance of the beam for shear surfaces b-b and c-c of Figure 2, which is typically not the case in UK construction. For composite slabs of normal depth, where the mesh is positioned at around the same level as the head of the stud (or slightly above), failure as described by surface/plane b-b (or even c-c), would not be expected to occur and one could argue that the reinforcement would still be effective. For example, for the surface b-b shown in Figure 2, a different failure mode such as concrete splitting above the stud head (i.e. over the full depth of slab) would be expected to precede, in which case the mesh reinforcement would be able to resist. However, this may not be true for deeper slabs where the distance between the mesh and the head of the stud is greater.

Conclusions / recommendations

Based on the above discussion, for slabs deeper than 180 mm, SCI advises the following:

- The minimum degree of shear connection requirement can still be based on SCI P405 for unpropped beams. For propped beams, further analysis is required, as the current rules in SCI P405 may become unconservative.
- It is advised that a second layer of mesh is placed locally over the beams near the top of the steel profile (or simply resting on it). This second layer of mesh needs to be properly anchored on both sides in the transverse direction, therefore it should extend a distance at least equal to the design anchorage length calculated according to BS EN 1992-1-1[5].

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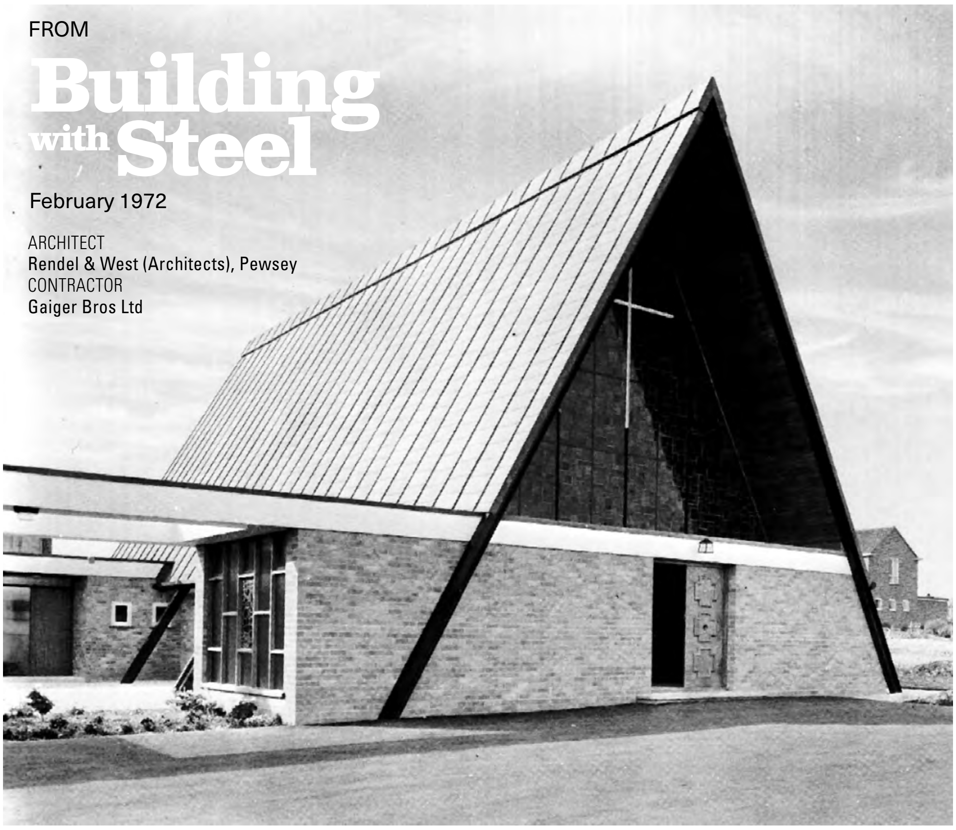
[3] NCCI PN001a-GB: Resistance of headed stud shear connectors in transverse sheeting, SCI, 2010.
[4] A.L. Smith, G.H. Couchman (2010) Strength and ductility of headed stud shear connectors in profiled steel sheeting, Journal of Constructional Steel Research 66, 748-754
[5] BS EN 1992-1-1:2004+A1:2014, Eurocode 2: Design of concrete structures - General rules and rules for buildings, BSI.

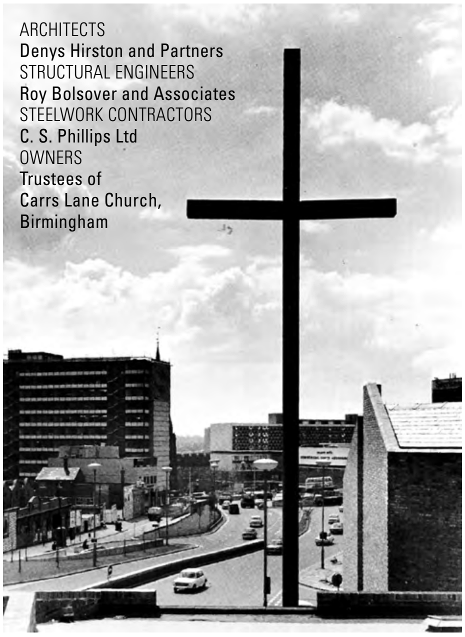
Churches and Steel

Churches are being built for new centres of population and to replace older structures no longer suitable. They take many forms depending on the available resources. Steel is often employed for the structure and these recent examples of church architecture demonstrate how it can meet the architect's needs.



Pewsey Roman Catholic Church

Conder A frames were used on this unusual church at Pewsey. This again demonstrates how standard industrialized components can be adapted to buildings quite different to those for which they were originally conceived.



Carrs Lane Church, Centre Cross, Birmingham

The cross which is illuminated at night is the most prominent external feature of the church and has been placed to fulfil three particular functions.

1. To mark the position of the church in the townscape. The church is quite near to the Bull Ring, Birmingham.
2. To proclaim the fact that this is a Christian building.
3. To mark the principal entrance of the building.

The cross is manufactured in Cor-Ten steel and is 72ft in length and projects 60ft above ground level. The cross arm is 16ft long and occurs 48ft above ground. The members consist of 12in x 12in mild steel universal column sections and are cased with ¾in thick shot-blasted Cor-Ten. The overall size of the section is 13⅝in x 14½in. The complete cross weighs 8½ tons and the concrete foundation is 6ft square.

Steel was chosen for this cross because it enabled the designers to produce a slender profile and the appearance of the weathered Cor-Ten would be most attractive.

Roman Catholic Church of St Hugh of Lincoln, Knaphill, Surrey

The pictures show clearly that this church is well finished in a pleasing simple style. Total area is $193m^2$ but the effect is to seem considerably larger.

This church has a Conder frame lucidly demonstrating that industrial structures have uses far removed from factories and warehouses.

Steelwork contractors for buildings

Membership of BCSA is open to any Steelwork Contractor who has a fabrication facility within the United Kingdom or Republic of Ireland. Details of BCSA membership and services can be obtained from

Lorraine MacKinder, Membership Manager
The British Constructional Steelwork Association Limited, Unit 4 Hayfield Business Park, Field Lane, Auckley, Doncaster DN9 3FL
Tel: 020 7747 8121 Email: *lorraine.mackinder@steelconstruction.org*

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.

Company name	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 £3,000,000
Adey Steel Ltd	01509 556677	●		●	●	●	●	●	●	●	●			●	●	✔	3		Silver	Up to £3,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●							●		✔	2	✔	Gold	Up to £3,000,000
AJ Engineering & Construction Services Ltd	01309 671919			●	●		●		●	●	●			●	●	✔	4		Silver	Up to £3,000,000
Angle Ring Company Ltd	0121 557 7241												●			✔	4			Up to £1,400,000*
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2		Bronze	Up to £1,400,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●	●	●				●		2			Up to £800,000
ASME Engineering Ltd	020 8966 7150			●	●	●		●		●	●			●	●	✔	4		Gold	Up to £4,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●			●	●			●	●	✔	2			Up to £1,400,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●	●	✔	2	✔	Silver	Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●			●	✔	4	✔	Silver	Up to £1,400,000
Barnshaw Section Benders Ltd	0121 557 8261												●			✔	4			Up to £1,400,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	Silver	Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	Gold	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		4			Up to £3,000,000
Bourne Group Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	Gold	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●		●	●	●	✔	4		Bronze	Up to £6,000,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●						●	✔	4		Gold	Up to £6,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	Gold	Above £6,000,000
Cementation Fabrications	0300 105 0135	●			●		●	●	●	●	●		●	●	●	✔	3		Gold	Up to £6,000,000
CMF Ltd	020 8844 0940				●		●	●		●	●				●	✔	4			Up to £6,000,000
Cook Fabrications Ltd	01303 893011			●	●		●	●		●	●			●	●	✔	2			Up to £1,400,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	4			Up to £1,400,000
DAM Structures Ltd	01377 271843	●		●	●	●		●	●	●	●			●		✔	4			Up to £6,000,000
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £200,000
D Hughes Welding & Fabrication Ltd	01248 421104				●	●	●	●	●	●	●		●	●	●	✔	4			Up to £400,000
Duggan Steel	00 353 29 70072	●	●	●	●	●	●	●	●		●				●	✔	4			Up to £6,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	4		Gold	Up to £3,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●	●	✔	4	✔	Gold	Up to £6,000,000
EvadX Ltd	01745 336413		●	●	●	●	●	●		●	●	●			●	✔	3		Gold	Up to £4,000,000
Four Bay Structures Ltd	01603 758141			●	●	●	●	●		●	●			●	●		2			Up to £1,400,000
Four-Tees Engineers Ltd	01489 885899	●			●		●	●	●	●	●		●	●	●	✔	3		Certificate	Up to £2,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●	●	✔	2			Up to £1,400,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**BIM**	**SCM**	**Guide Contract Value (1)**

Company name	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	✔	● (green)	Up to £3,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £3,000,000
Harry Peers Steelwork Ltd	01204 528393	●		●	●	●	●	●	●		●					✔	4			Above £6,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●	✔	2			Up to £3,000,000
Hillcrest Structural Steel Ltd	023 8064 1373			●	●	●	●	●		●	●			●	●	✔	3		● (lilac)	Up to £3,000,000
Intersteels Ltd	01322 337766	●			●	●	●	●	●	●			●	●	●	✔	3			Up to £3,000,000
J & A Plant Ltd	01942 713511				●										●		4			Up to £40,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●				●	●					4			Up to £6,000,000*
Kiernan Structural Steel Ltd	00 353 43 334 1445	●		●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	● (lilac)	Above £6,000,000
Kloeckner Metals UK Westok	0113 205 5270												●			✔	4		● (lilac)	Up to £6,000,000
LA Metalworks Ltd	01707 256290				●	●				●	●			●	●	✔	2			Up to £2,000,000
Leach Structural Steelwork Ltd	01995 642000			●	●	●	●	●			●					✔	2		● (lilac)	Up to £6,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●				●	●	●			●	●		3			Up to £800,000
Littleton Steel Ltd	01275 333431				●					●	●			●	●	✔	3			Up to £1,400,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●			●	●	✔	4		● (green)	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
Mifflin Construction Ltd	01568 613311			●	●	●	●				●						3			Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●	●	●		●				●	✔	4			Up to £2,000,000
Newbridge Engineering Ltd	01429 866722	●	●	●	●	●	●	●			●	●				✔	4		● (lilac)	Up to £2,000,000
North Lincs Structures	01724 855512			●	●					●	●				●		2			Up to £800,000
Nusteel Structures Ltd	01303 268112						●	●	●	●				●		✔	4		● (yellow)	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 £1,400,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		3			Up to £1,400,000
REIDsteel	01202 483333			●	●	●	●	●	●	●	●	●	●		●	✔	4		● (yellow)	Up to £6,000,000
SAH Luton Ltd	01582 805741			●	●	●				●	●			●	●		2			Up to £400,000
S H Structures Ltd	01977 681931	●		●	●	●	●	●	●	●	●	●	●		●	✔	4	✔	● (yellow)	Up to £3,000,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●			●	●			●	●	✔	4			Up to £2,000,000
Severfield plc	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	● (yellow)	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 £4,000,000
Taziker Industrial Ltd	01204 468080	●		●	●		●			●	●		●	●	●	✔	3		● (yellow)	Above £6,000,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●			●	●			●	●	✔	2			Up to £400,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●			●	●	✔	3	✔	● (lilac)	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●	●			●			●			2	✔		Up to £2,000,000
Underhill Engineering Ltd	01752 752483				●		●	●	●	●	●			●	●	✔	4	✔		Up to £3,000,000
W I G Engineering Ltd	01869 320515				●					●	●			●	●	✔	2			Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4			Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●	●	●	●	●	●	●				●	✔	4		● (green)	Up to £800,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	● (yellow)	Above £6,000,000

Company name | Tel | C | D | E | F | G | H | J | K | L | M | N | Q | R | S | QM | FPC | BIM | SCM | Guide Contract Value (1)

Steelwork contractors for bridgeworks

The Register of Qualified Steelwork Contractors Scheme for Bridgeworks (RQSC) 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 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			✓	Silver	Up to £3,000,000
AJ Engineering & Construction Services Ltd	01309 671919	●			●	●	●	●	●			●	✓	4				Silver	Up to £3,000,000
Billington Structures Ltd	01226 340666	●		●	●	●	●					●	✓	4	✓	✓	✓	Gold	Above £6,000,000
Bourne Group Ltd	01202 746666	●			●	●				●		●	✓	4	✓		✓	Gold	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓	Bronze	Up to £6,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●	●	●	●		●	●	●	✓	4			✓	Gold	Up to £6,000,000
Cementation Fabrications	0300 105 0135	●		●	●	●	●					●	✓	3			✓	Gold	Up to £6,000,000
D Hughes Welding & Fabrication Ltd	01248 421104	●		●		●			●	●	●	●	✓	4			✓		Up to £400,000
Donyal Engineering Ltd	01207 270909	●		●						●	●	●	✓	3		✓	✓	Silver	Up to £1,400,000
ECS Engineering Services Ltd	01773 860001	●			●	●	●		●			●	✓	4				Gold	Up to £3,000,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●	●	●		●	●	●	●	✓	3			✓	Certificate	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●			●	●				●	●	●	✓	4	✓		✓	Gold	Above £6,000,000
M Hasson & Sons Ltd	028 2957 1281	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓	Certificate	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 £2,000,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	Gold	Up to £6,000,000
REIDsteel	01202 483333	●				●	●	●				●	✓	4				Gold	Up to £6,000,000
S H Structures Ltd	01977 681931	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓		✓	Gold	Up to £3,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓	✓	✓	Gold	Above £6,000,000
Shaun Hodgson Engineering Ltd	01553 766499											●	✓	3					Up to £800,000
Taziker Industrial Ltd	01204 468080	●		●	●	●	●	●	●	●	●	●	✓	3		✓	✓	Gold	Above £6,000,000
Underhill Engineering Ltd	01752 752483	●	●	●	●	●				●	●	●	✓	4	✓		✓	Gold	Up to £3,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●		●	✓	4	✓	✓	✓	Gold	Above £6,000,000
Non-BCSA member																			
Allerton Steel Ltd	01609 774471	●	●	●	●	●	●	●			●	●	✓	4	✓		✓	Certificate	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 £3,000,000
Cimolai SpA	01223 836299	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	Certificate	Above £6,000,000
CTS Bridges Ltd	01484 606416	●	●	●	●	●	●	●	●		●	●	✓	4			✓	Certificate	Up to £1,400,000
Harrisons Engineering (Lancashire) Ltd	01254 823993			●	●	●	●	●	●	●		●	✓	3		✓			Up to £1,400,000
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
In-Spec Manufacturing Ltd	01642 210716									●	●	●	✓	4			✓		Up to £800,000
J&D Pierce Contracts Ltd	01505 683724	●		●	●	●	●	●	●		●	●	✓	4			✓		Above £6,000,000
Kelly's Welders & Blacksmiths Ltd	01383 512 517											●	✓	2			✓		Up to £200,000
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	Gold	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 £800,000
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		✓	✓	Silver	Above £6,000,000

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
MMCEngineer Ltd	01423 855939
Paul Hulme Engineering Ltd	07801 216858
QHSE-Interspect Ltd	07438 413849
Sandberg LLP	020 7565 7000
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				
FLI Structures	01452 722200	✓	M	4	20	● (Gold)	
Hadley Industries Plc	0121 555 1342	✓	M	4		● (Gold)	
Hi-Span Ltd	01953 603081	✓	M	4		● (Certificate)	
Jamestown Manufacturing Ltd	**00 353 45 434288**	✓	**M**	4	20		**Gold**
Kingspan Structural Products	01944 712000	✓	M	4		● (Gold)	
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)	**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				
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			● (Silver)	
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			● (Gold)	
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		● (Gold)	
Duggan Profiles & Steel Service Centre Ltd	00 353 567722485	✓	M	4			
Kloeckner Metals UK	0113 254 0711	✓	D/I	4	3B	● (Gold)	
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		

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				
Tension Control Bolts Ltd	**01978 661122**	✓	**M**		**3**		**Silver**

Welding equipment and consumables

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