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NSC

April 2019
Vol 27 No 4

Steel sparkles in Hampshire

Steel transforming Edinburgh

Rochdale's Riverside regeneration

Time for steel in Warrington

Food processing for Suffolk

Cover Image
Edinburgh St James
Main client: Nuveen
Architect: BDP
Main contractor: Laing O'Rourke
Structural engineer: Arup
Steelwork contractor: BHC
Steel tonnage: 15,000t

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Selecting steel defines success

Nick Barrett - Editor

Building on brownfield sites is being championed by a new campaign from the Campaign to Protect Rural England (CPRE) as a way to ensure enough land can be brought into use to combat the UK's housing shortage while avoiding building over green belt areas. Steel construction is equally appropriate for brownfield as well as greenfield sites.

Housing, important as it is, isn't the only need that is met by using brownfield sites, many of which couldn't be developed economically or perhaps at all if it wasn't for steel construction's capabilities, like being able to access tight inner-city sites for example.

As the CPRE said at the launch of their campaign, building on brownfield presents a fantastic opportunity to simultaneously remove local eyesores and breathe new life into areas crying out for regeneration. Steel has certainly proven its worth over the years on a multitude of projects that have breathed new life into entire areas, regenerating town and city centres throughout the UK.

In this issue of NSC we have the example of the £1,000 million Edinburgh St James project adjacent to the city's Waverley Station and in the shadow of the iconic Edinburgh Castle, where large transfer structures are enabling a complex construction including a 13-storey hotel and major retail units. Old concrete columns are being replaced with steel and steel's offsite credentials mean that a potentially large workforce is being kept to manageable levels.

This is one of the most substantial regeneration projects under way in the UK and will change the face of Edinburgh.

A bit further south in Rochdale, we report on the latest project in an ambitious regeneration scheme which has featured steel construction throughout. This retail and leisure project has benefitted from a value engineering exercise carried out by steelwork contractor Hambleton under a design and build contract. Many projects would benefit from this sort of input if steelwork contractors were involved at the earliest stages of project planning, as the BCSA has continually emphasised.

Another retail-led regeneration in this issue is taking place at Warrington, part of a £110 million mixed-use scheme to regenerate a large part of the town centre comprising four steel-framed structures. The design is recognised as complex in parts, which is part of the reason that steel was selected according to the main contractor. Client Warrington Council says using steel has given them great confidence that the project will be delivered on time.

Other examples of steel supporting regeneration on brownfield sites can be read about in this month's news, projects that are likely to feature in NSC at appropriate times. One of the most interesting is the Soho Place mixed-use scheme above the new Tottenham Court Road Crossrail Station. This landmark project will include a nine-storey and a 10-storey building above the first new theatre to be built in the West End for over 50 years. To call the site complex is a bit of an understatement, with piling having to contend with central London services and tube lines underneath.

Unless we build on parks and other recreational green spaces, inner-city developments are almost by definition on brownfield sites. And steel is often the definitive solution.

Major milestone reached on A14 improvement scheme – the UK's biggest road upgrade

Highways England has announced that structural works for the 750m-long River Great Ouse Viaduct, which forms a major part of the A14 Cambridge to Huntingdon Improvement Scheme, have been completed.

Said to be the UK's biggest road upgrade, the £1.5bn scheme will transform journeys on one of the East of England's most vital roads, and the completion of the viaduct is the latest piece of the puzzle to be put in place.

Willie McCormick, Construction Director for the A14 Cambridge to Huntingdon Improvement Scheme on behalf of Highways England, said: "This viaduct over the River Great Ouse, south of Huntingdon, is by far the biggest bridge on our 21-mile project. It's taken over 18 months to build, and covers 750m to carry drivers over the river and floodplain – yet when it opens to traffic in 2020, drivers will cross it in less than 30 seconds.

"Our hardworking team is building 34 new bridges and structures as part of this epic project to deliver a new and improved A14."

Some 64 pillars are needed to carry the viaduct over the River Ouse floodplain, each around 2m-wide and embedded up to 30m in the ground. The pillars support the 17 spans of steel beams and concrete slabs which form the bridge deck. When the new A14 fully opens by December 2020, the bridge will help to reduce journey times on the road by up to 20 minutes.

Most of the viaduct's main girders are up to 40m-long, 2m-deep and weigh 50t. The section of bridge that crosses the river has a longer 70m span, requiring more complex girders, with larger, deeper haunches to carry the greater load.

Working on behalf of main contractor Costain Skanska Balfour Beatty JV, Cleveland Bridge erected 6,000t of steel for the viaduct comprising 76 main girders and 800 cross members.

Steel takes off for Luton Airport car park

Working on behalf of Buckingham Group, James Killelea is fabricating, supplying and erecting 2,450t of steelwork for Luton Airport's new five-level multi-storey car park.

Measuring 80m × 114m and containing two external ramps, the car park forms an integral part of the Airport's expansion programme that will increase its annual capacity by 50% to 18M passengers by 2020.

The works also include an extension to the existing terminal building and a new two-storey pier.

The £150M project is critical to meet increasing air travel demand in London, the South East and South Midlands over the next two decades.

Fabsec launches updated cellular beam software

Long span cellular beam designer Fabsec, has launched its updated FBEAM 2019 software, which it claims will help steelwork designers achieve greater levels of project performance and efficiency.

The FBEAM ambient cellular beam free software is typically used to design primary and secondary floor beams and rafters for multi-storey projects. Fabsec cellular beams can be composite and non-composite with typical spans of between 8m and 24m, and roof spans of up to 60m.

One of the updates to the FBEAM software is the addition of a Fire Engineering Module, that allows the design of beams using the latest intumescent coatings.

The module calculates the optimum structural section size and the intumescent coating thickness to determine the most cost-effective combination.

Fabsec FBEAM software can be downloaded in the UK from the company's new website: www.fabsec.co.uk

Also, available on the website is Fabsec's new promotional video: *https://youtu.be/dYCqIBaXNQk*

Bespoke design for central London mixed-use scheme

Located in the central London district of Fitzrovia, the 80 Charlotte Street development is using an architecturally-driven bespoke design, which includes all internal steelwork being left fully-exposed within the completed building.

Referred to as an industrial-look, the exposed steelwork, combined with the 9m × 6m column grid pattern, creates a contemporary and spacious office environment.

"The exposed internal steelwork and the connecting bolts will be a feature element within the building, so all of the end plates are flush and the beams and columns are all being repainted once they have been lifted into position in order to get the best possible high-quality decorative finish," said Bourne Steel Divisional Manager Kevin Springett.

Steelwork supports precast flooring planks to form the project's floors. Because the underside will be left exposed, the precast planks have been manufactured with a high-quality finish.

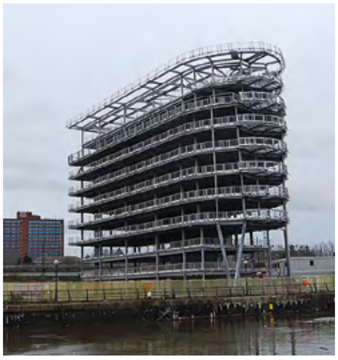
Working on behalf of Multiplex, Bourne Steel has erected 3,200t of steel for the project, along with the installation of 4,800 precast planks.

Overall, the 35,000m^2 scheme comprises three separate buildings: the main 80 Charlotte Street part - a nine-storey new build that infills a rectangular block that is also bounded by Whitfield Street, Chitty Street and Howland Street - as well as the adjacent 65 and 67 Whitfield Street.

The latter are two existing structures that have been renovated, with each one receiving three new steel-framed floors enabling them to offer 1,114m^2 of offices and 4,180m^2 of residential space.

The 80 Charlotte Street development is due to complete in December 2019.

Canalside apartments launched in Manchester



Elland Steel Structures has completed the steelwork for the first block for a new residential scheme beside the Manchester Ship Canal.

Known as Manchester Waters, the project will help regenerate Pomona island, a strip of land adjacent to the Canal, which has been identified as a new destination for business, residential and leisure by the local authority.

It is being developed by X1 with Liverpool-based Vermont Construction as main contractor. In total, the scheme is set to deliver five blocks in two phases, with the first two blocks (phase one) due to be complete by early next year.

The initial two steel-framed blocks are 10-storeys and 12-storeys high and will contain a total of 216 apartments. These will be a mix of studio, one, two and three-bed units.

The planned second phase will consist of three blocks of 15-storeys, 17-storeys and 19-storeys that will bring a further 526 new homes to the market.

Stevenage appoints Mace for town centre regeneration

Stevenage Borough Council and Mace have announced the signing of a major new agreement to work in partnership on the long-term transformation of Stevenage Town Centre.

Known as SG1, the agreement builds on a vision for regeneration developed by the council over several years and seeks to create a whole new quarter of five distinct character areas on the western side of the town centre.

The mixed-use regeneration scheme includes plans to create a series of new streets within Stevenage, as well as a redesigned, modern town square.

The development will also create new public spaces, alongside a public services hub that will bring together key council services in a single building. The hub will include a new library and health facilities, allowing residents easy access to high quality services at one location.

Work is expected to take place over several phases with the first construction project commencing in 2020.

Cllr Sharon Taylor, Leader of Stevenage Borough Council, said: "This is an exciting time for Stevenage and the future of our town centre. Signing this deal with Mace highlights our ambitions to grow our town and improve the services and amenities we currently offer to residents.

"We've seen a number of smaller projects already completed in our town centre as part of the regeneration programme including Market Place, Vista Tower and more, but SG1 will be one of the critical elements in driving significant, positive changes to our town."

NEWS IN BRIEF

Trimble has launched Tekla PowerFab, a new software package for steel fabrication management. Said to have been created specifically for steelwork contractors, Tekla PowerFab offers collaboration across project teams throughout the whole structural steel workflow.

Cleveland Bridge has secured a contract for the prestigious refurbishment of the Humber Bridge, a structure it helped construct more than 40 years ago. Working alongside Aecom, it will undertake the inspection of eight main cable panels, which each measure 18m in length.

Plans have been revealed for a new **Tees Crossing**, which is aimed at relieving congestion on the busy A19 Tees Viaduct. Two options are being considered including a new two-lane bridge parallel to the existing viaduct. This would carry traffic travelling northbound while the existing viaduct would be widened to allow for an extra lane of southbound traffic. Known as the Tees Viaduct Capacity Enhancement Option, the scheme has been budgeted to cost between £200M and £250M.

Ask Real Estate, in a joint venture with the Richardson family and PATRIZIA, has exchanged a pre-let agreement with Whitbread for a 200-bedroom Premier Inn hotel at First Street, Manchester. The hotel operator will occupy the top five floors of a new 16-storey mixed-use development, which secured planning permission in December 2018. Construction of the new building will start this summer with completion due in early 2021.

London & Quadrant (L&Q) and **Countryside Housing** have formally received planning consent for its mixed-use Beam Park regeneration scheme on the old Ford Dagenham plant in East London. When the master plan is complete in 2030, Beam Park will provide over 3,000 new homes, a railway station next to a public square, as well as a medical centre, and retail and commercial space.

Forward Protective Coatings has added a powder coating division at its Shirebrook works to compliment the current wet spraying operations. The company's Managing Director Peter Everington said the one-stop coatings service will give added benefits to existing customers as well as new clients.

PRESIDENT'S COLUMN

Most of us already know that the government wants construction and infrastructure projects to incorporate greater levels of offsite manufacturing. But more recently, government has said that it also wants to take a more standardised approach to design, including componentisation. They refer to this as a platforms approach.

With the majority of the value add for structural steel already occurring offsite – in some cases up to 90% - the structural steelwork sector is well placed to be an early adopter of these new approaches.

Key to the success of this approach will be the ability to lock down the complete design. The current construction delivery model does not allow the design to be fixed and drives late changes to design driven by individual sub-contractors as they are engaged. This lack of design certainty is the biggest issue facing steelwork contractors today and one of the largest drivers of cost. BCSA believes late and incomplete design, design errors, and ongoing design changes could currently add up to 15% - 20% in cost to a construction project.

For a platforms approach to be successful, the construction delivery model will have to become collaborative, incorporate early engagement, and demonstrate a high level of coordination and integration. Fixity of design and early engagement of subcontractors would be a significant positive change for the construction sector, even on a structure by structure basis.

While the structural steelwork sector already commonly uses a narrow range of section sizes and three standard connection designs, as well as generally using one standard bolt size, the overall building or structure design is sometimes so bespoke that the standard components and designs are unable to be utilised as often as they could be.

A balance does needs to be struck between over and under application – there is the risk of over application where the benefits of the approach start to get lost. If a platforms approach standardises more than is practical, it may be that the building design becomes less efficient than other design solutions, including offsite manufacturing or traditional techniques.

In its early stages, a platforms approach is most likely to be an alternative to both modular and panelised off-site build systems designed for; for example, student accommodation, low-rise hotels and low-rise residential type structures. This is due to their regular grid, repetitive design and limited number of storeys.

While a platforms approach itself will not necessarily be the optimum solution for all buildings and infrastructure projects, the principles of fixed or standardised design and inter-operability provide a solution for many buildings and will have wider benefits in effecting positive change.

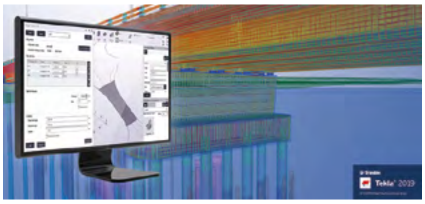
Tim Outteridge
BCSA President & Sales Director Cleveland Bridge

Trimble introduces new Tekla structural BIM software

Trimble has introduced the latest versions of its Tekla Building Information Modelling (BIM) software solutions for the construction industry: Tekla Structures 2019, Tekla Structural Designer 2019, Tekla Tedds 2019 and Tekla EPM 2019

Tekla Structures 2019 is said to deliver enhancements, improvements and new features, that together result in smoother workflows, more precise control and higher productivity levels.

The latest version of the software offers improved geometry for the detailing of curved structures,



such as bent plates and staircases, and contains new automated features for model-based drawing production.

Tekla Structures 2019 is also said to include a host of new tools, such as Revit Export, an extension which provides greater flexibility and a new Bridge Creator extension.

Trimble said the Tekla Structural Designer 2019 introduces various updates focussed around flexibility and interoperability, making for a more streamlined and efficient user experience.

This includes a new core walls tool that is said to enhance real-world simulation and constructible modelling, while the recently improved data export feature focuses on the interoperability with both Tekla Structures and Autodesk Revit.

Tekla 2019 versions can be downloaded at: *www.tekla.com/2019*

First UK galvanizer gains fit for nuclear status

Joseph Ash Galvanizing has recently been granted 'Fit For Nuclear' status (F4N), and claims to be the first galvanizing company in the UK to become accredited.

F4N is a unique service to help UK manufacturing companies get ready to bid for work in the nuclear supply chain and to measure their operations against the standards required to supply the nuclear industry – in new build, operations and decommissioning.

Mick Jackson, IT and Marketing Manager at Joseph Ash Galvanizing said "Many thanks to everyone at Joseph Ash who has worked hard to achieve this status. Thank you also to F4N for granting us the certificate. We look forward to our growing relationship with the nuclear industry."

F4N Fit For Nuclear

Developed by the Nuclear AMRC with the support of its top tier partners, F4N includes nuclear new build developers and the Nuclear Decommissioning Authority. These industry leaders are using F4N to identify potential companies for their own supply chains.

Contracts signed for major Soho mixed-use scheme

Laing O'Rourke has signed a construction contract for the steel-framed Soho Place development in central London.

Soho Place is a mixed-use scheme above the new Tottenham Court Road Crossrail Station. It will comprise a 10-storey building with retail and office space, coupled with a nine-storey building split into three offices above a 600-seat theatre, the first to be built in the West End of London for over 50 years.

Appointed preferred bidder in July 2018, Laing O'Rourke has been delivering enabling works for the project. It has now officially started on main construction with the team concentrating on some challenging piling above and around the web of services and tube lines that sit below the site.

BHC will be fabricating, supplying and erecting the project's structural steelwork.

Liam Cummins, Head of UK Building for Laing O'Rourke said: "We look forward to delivering Soho Place, further strengthening our partnership with

Derwent London. This will be a landmark project, sitting at 1 Oxford Street, and interconnected with the Crossrail upgrades to Tottenham Court Road, which we are also delivering."

Richard Baldwin, Head of Development of Derwent London, said: "We are very excited about the prospects for Soho Place, which will be a great building in one of the best locations in London. We are also very pleased to be working with Laing O'Rourke, who we believe have the capabilities to deal with the complexity of the site."

The development is due for completion in November 2021.

Advanced manufacturing facility lands in Wales

The Welsh Government is investing £20M in a flagship development that will improve productivity, skills and innovation across a range of sectors including aerospace and automotive.

Located alongside the Airbus UK manufacturing centre in Broughton, Flintshire, the facility will be managed by the University of Sheffield Advanced Manufacturing Research Centre (AMRC), who will occupy half the new building, with Airbus taking the other half.

The facility is housed in a large twin-span propped portal frame that measures 80m-long x 60m-wide with a maximum height of 24m. One row of offset internal valley columns separate the main workshop part of the building into two parts, one with a span of 33m and the other 27m.

One end of the structure houses a full-width office block, that is divided in half by an entrance and atrium.

One half of the block is two-storeys high and will accommodate the offices, while the other side is four-storeys and will house further office space on the ground floor, a first-floor canteen and then two upper levels for plant equipment.

Working on behalf of main contractor Galliford Try, EvadX has fabricated, supplied and erected the project's steelwork.

Galvanizer completes lead-free conversion

Wedge Group Galvanizing has completed what is claimed to be a unique conversion to become the UK's first lead-free galvanizing company.

The company said it made the decision to eliminate lead from its process at all of its 14 plants across the UK 10 years ago.

Managing Director of Wedge Group Galvanizing Chris Woolridge said: "The amount of lead used in a traditional galvanizing process is very small but we wanted to remove it from our processes completely and made a firm commitment to do that 10 years ago.

"We have put a significant amount of time and effort into perfecting a methodology that produces even better results than before.

"The fact we believe we're the first galvanizing company in the UK to run a lead-free operation is a fantastic achievement."

The initiative was made particularly timely by the 2018 reclassification of lead massive contained in REACH (an EU regulation for the Registration, Evaluation and Authorisation of Chemicals).

Technical Services Director at Wedge Group Galvanizing David Nobes said: "The reclassification could turn into a major headache for some of our customers, who might have to meet exceptionally tight tolerances or demonstrate exacting procedures. Some might even review the use of any process that involves lead as a result.

"Because of the commitment we made 10 years ago, our process doesn't use lead at all and therefore removes any potential issues."

Nottingham Forest kicks off expansion plans

Championship football club Nottingham Forest has confirmed that, after extensive negotiations with the City Council, its stadium will undergo a wholesale redevelopment

The City Ground's redevelopment will see the creation of a new world-class Peter Taylor Stand and improvements to the Brian Clough and Bridgford Stands.

The new, modern, state-of-the-art structure will see The City Ground's capacity become the highest in the East Midlands, reaching 38,000 after completion.

The new Peter Taylor Stand will see the introduction of world-class facilities including a museum, a new club shop, range of hospitality lounge options and restaurants, and executive boxes.

In addition, there will be new spacious concourses for general-admission supporters as well as improved facilities for supporters with disabilities and a substantial increase in wheelchair spaces.

The club will now enter a period of consultation and engagement with the relevant supporter groups before making the necessary planning application.

Subject to the relevant consents, the club is hopeful that building work will commence at the end of the 2019-20 season.

Diary

For SCI events contact Jane Burrell, tel: 01344 636500 email: *education@steel-sci.com* web: *www.steel-sci.com/courses*

Tuesday 7 May 2019
Plate Girder Design - Webinar
Plate girders are a good solution to long span heavily loaded beams. Although generally designed with software, design in accordance with BS EN 1993-1-5 is straightforward. The webinar will consider shear resistance, shear lag in the flanges and hybrid girders (different steel grades of flanges and web).

Thursday 9 May 2019
Steel Connection Design Course
The course concentrates on the design of nominally pinned connections, in accordance with BS EN 1993-1-8, considering vertical shear and tying. Birmingham.

Tuesday 21 May 2019
Essential Steelwork Design 2 day course
This course introduces the concepts and principles of steel building design, before explaining in detail the methods employed by Eurocode 3 for designing members in bending, compression and tension. Load combinations, frame stability, brittle fracture and connection design are also covered.
Cambridge

Thursday 6 June 2019
Light Gauge Steel Design Course
This course introduces the uses and applications of light gauge steel in construction, before explaining in detail the methods employed by Eurocode 3 for designing light gauge steel members in bending and compression and calculation of section properties. Specific design issues related to the different uses of light gauge steel are addressed.
London

Jamestown has the capabilities to manufacture intricate and complex bespoke fabricated steelwork

Jamestown - building for future strength

The steel industry is becoming more and more competitive and Jamestown says that in order to thrive now and in the future, it needs to constantly improve.

Process Improvements

Jamestown, at its production facility in Portarlington, is adopting a structured approach to increasing productivity, increasing output and reducing costs. Since moving to their 17-acre Portarlington site in 2015, the company has grown significantly and throughout this period has worked tirelessly to lay strong foundations for future success.

According to General Manager Niall Fortune, the issues with operating a steel fabrication facility of this size are sometimes hard to identify, but gradually they have come to learn that too much space can be as big a problem as too little space.

"Having recognised that like any other resource, space needs to be controlled and utilised to its best effect, we have begun a Lean Manufacturing drive which is helping to transform key areas of our business," says Mr Fortune.

Since moving to their current site, Jamestown has added further beam manufacturing equipment, beam profiling capability, high speed – high accuracy milling/drilling, and have improved their method of transforming steel plate into bespoke plate girders.

Enhanced Business Development Activity

Director Fiacre Creegan says: "It has always been our belief that without sales a business has nothing, and to this end Jamestown is boosting its business development team. Jamestown is delighted that Tim Outteridge has agreed to join its business development team and, coupled with the existing UK and ROI based business development expertise, is seeking to ensure a steady stream of profitable work to fill capacity in all sectors of the business."

Jamestown's UK Business Development Manager Mark Stewart adds: "The fantastic factory resource in Portarlington can offer the steel industry many different types of product from straightforward plate girder carcasses, to fully fabricated plate and box girders, to complete fully finished rail bridges and totally bespoke complex welded structures.

"We've made some superb fabricated steel products and I'm really looking forward to working closely with Tim to ensure Jamestown's continued success."

Broadening the Management Team

To meet the ever-increasing demands of compliance, quality, scheduling, and production forecasting and reporting, all of which are a must in a modern fast-moving steel facility, it is imperative that the overall management function within any company is adequately resourced to meet the demands placed upon it. For this reason, Jamestown has continually kept watch over the management side of the business and is quick to spot gaps as they emerge. 'The natural tendency can be to keep the overheads low,' says Jamestown's compliance

Clients' high-specification finish requirements are routine to Jamestown

manager, Mark Morris, 'but in truth if a business is to grow its output, turnover and profit, inevitably its management must also grow.

"Finding managers with the right attitude, skills, habits and experience is always a challenge and one in which Jamestown invests plenty of time and energy. We are continuing to grow and develop our team across all areas of the business whether this be accounts, technicians, machine operators or welder/fabricators. The people are the real key to any business and Jamestown fully recognises this," says Mr Creegan

Investment in Plant and Facilities

Jamestown's Heavy Fabrication Manager Aidan Clear says: "We're always looking to move away from old methods, once we can identify new and better ways of working. We're currently setting up a beam profiling line which will save us time in activities such as end-prepping webs and flanges, producing web openings, cellular beam manufacture, notching and cutting heavy sections to length. In this way, we aim to increase our throughput and reduce overall cost."

Jamestown also has equipment which hasn't been utilised fully since its move to Portarlington. A substantial saw & drill unit is being set-up at present and Jamestown is looking at diverting some existing resources towards offering this service to the wider steel industry in Ireland. Through this, the aim is to complement current services and use this as an opportunity to better serve a wider customer base.

Embracing Change

"Change is an ever-present part of the steel industry and the wider business sector. It's a constant. When we started making plate girder carcasses 15 years ago, the landscape was different. There was nobody talking about CE Marking, nobody knew what an IWE or RWC was, welding and fabrication was left to the fabricators and welders, and engineers kept their distance from the workshop," says Jamestown Carcass Welding Manager Mick McClean.

"Now the entire language of welding and compliance is much more scientific. It's a big leap from basic S275JR plate to S460 NL with specific carbon equivalent values and restrictions on origin. The whole industry, particularly at the top end, has moved in a direction of complexity and into a tightly specified, more academic environment. As a big player in the bespoke steelwork game, at Jamestown we've embraced this change and tooled up with the in-house and consultant skills and with the management know-how to deal with increasing quality compliance requirements."

In this way, Jamestown can offer customers complete assurance that its bespoke steelwork has come through a rigorous and robust quality environment, with the best of attention paid to every critical aspect of its manufacture.

"By doing this, and by continually improving our offering to the UK and Republic of Ireland steel market, we are very deliberately building our strength for the future," says Mr McClean.

Mr Creegan concludes by explaining that Jamestown is a company built on a long history of solid engineering expertise and good business judgement. He emphasises that hard work and focus has been the hallmark of their efforts in the past. Jamestown is building towards the future, and with good decision making now, followed by clear action, and coupled with plenty of effort from a great group of employees, Jamestown is set to continue its success and remain strong into the future.

Jamestown is a headline sponsor of *Steel for Life*

STEEL for life

Jamestown have manufacturing facilities to produce some of the largest steelwork around, to the highest quality levels

Poultry farm lands in Eye

The steel frame was erected in 14 weeks

Leading UK food producer Cranswick is constructing a new £60M steel-framed poultry facility in Eye, Suffolk.

FACT FILE
Cranswick poultry facility, Eye, Suffolk
Main client and contractor: Cranswick Country Foods
Architect and structural engineer: Trundley Design Services
Steelwork contractor: A C Bacon Engineering
Steel tonnage: 1,200t

A greenfield site on a rural airfield in Eye, Suffolk is being converted into a new state-of-the-art poultry facility by food producer Cranswick.

The company says the new site, which is due to open later this year, will be one of the most efficient and sustainable poultry processing facilities both in the UK and Europe, supplying leading UK retailers and other manufacturers with fresh produce.

The site will employ over 700 people, with approximately 300 new jobs created in the region and the remaining staff transferred from Cranswick's existing production facility.

Cranswick already operates three food processing sites and runs pig and chicken farming operations across Norfolk and Suffolk; employing over 2,000 people in the region. This latest project is the largest single investment it has ever undertaken.

In a bid to bring as much benefit to the local community as possible, Cranswick has awarded over £10M of the project costs to local contractors,

This has seen Kings Lynn-based Trundley Design Services being contracted to undertake both architectural and structural engineering responsibilities for the project, and Norfolk-based A C Bacon Engineering being subcontracted to fabricate, supply and erect the steelwork.

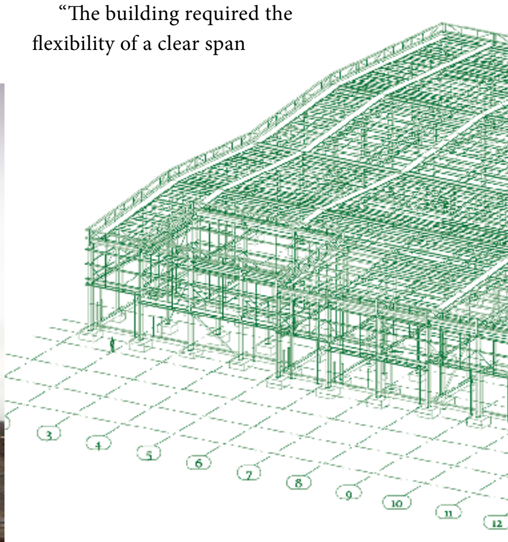
Trundley Design Services Managing Director Ian Trundley says: "After over a year in the designing and planning phase with Cranswick, we are delighted that the building of the new food processing facility has commenced and is currently on schedule for completion in October 2019. It is very rewarding to see the building work come to life and our dedicated project team remain focused on the continued delivery of this prestigious project."

Work on site kicked off last year with another local firm completing the groundworks contract. This work included the excavation of more than 80,000t of earth, in order to flatten and prepare the plot. Supporting the steel frame over 10,000t of concrete pad foundations were also installed.

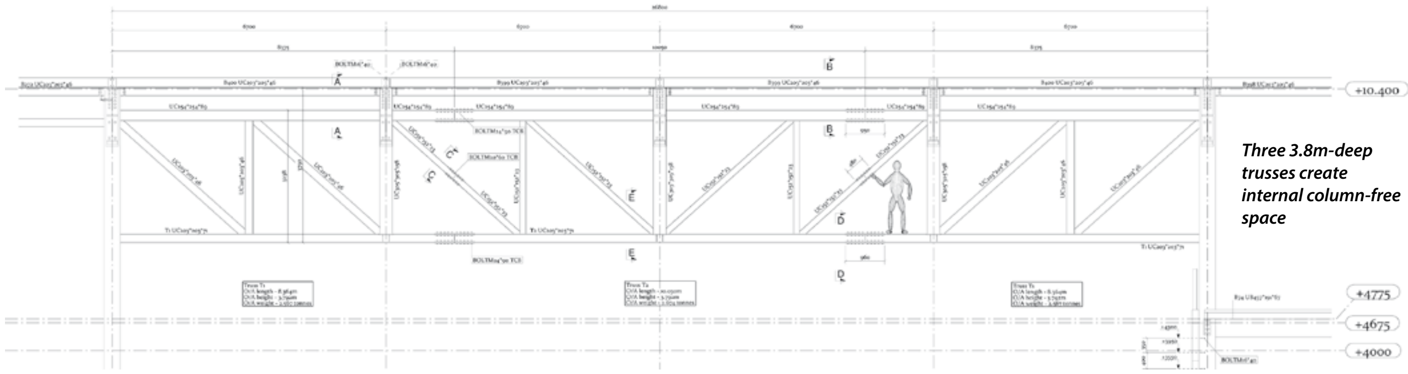
The poultry facility consists of one large steel-framed structure which is 219m long and 116m wide at the widest part, with a maximum height to the underside of the eaves of 10m.

"The building required the flexibility of a clear span

The building has a maximum width of 116m



Model showing the steel frame, with the office block and entrance hub on the right



Three 3.8m-deep trusses create internal column-free space

with minimal internal columns. Due to the complexity of the internal equipment layout the steelwork had to be effectively designed around this restriction. Based on this, the only material that could fit the criteria was steel," adds Mr Trundley.

The food production part of the facility accounts for 189m of the overall length, while the rest is occupied by a two-storey office area and an 11m-long entrance pod.

The majority of the production area is 78m wide and consists of a twin portal frame with two 39m-wide spans. For approximately one third of the production area's length there are attached mono-pitch structures on either side that provide extra workspace and bring the structure up to its maximum 116m width.

"To form the roof of the structure we delivered most of the rafters to site in 18.5m lengths, spliced them together on the ground to form 39m-long sections and then lifted the complete pieces into place," explains A C Bacon Engineering Commercial Manager Ryan Bailey.

A C Bacon Engineering used two of its own 60t-capacity mobile cranes for the steel erection programme, one positioned in each portal span. They then both worked their way down the entire frame erecting the two sides simultaneously.

Adding some more floor space to the production area, there is approximately 6,000m^2 of mezzanine flooring within both portals. Based around a 6.7m column grid pattern, the mezzanine levels as well as the two-storey office block, are formed by steel beams supporting precast slabs.

Creating more column-free space, two 26m-long × 3.8m-deep trusses have been installed along the structure's valley line. By installing these two 8t trusses, a total of eight central columns were able to be omitted.

The two trusses were the heaviest lifts on the job. For ease of transportation they were brought to site in three pieces, which were then assembled into 26m-long sections and lifted into place.

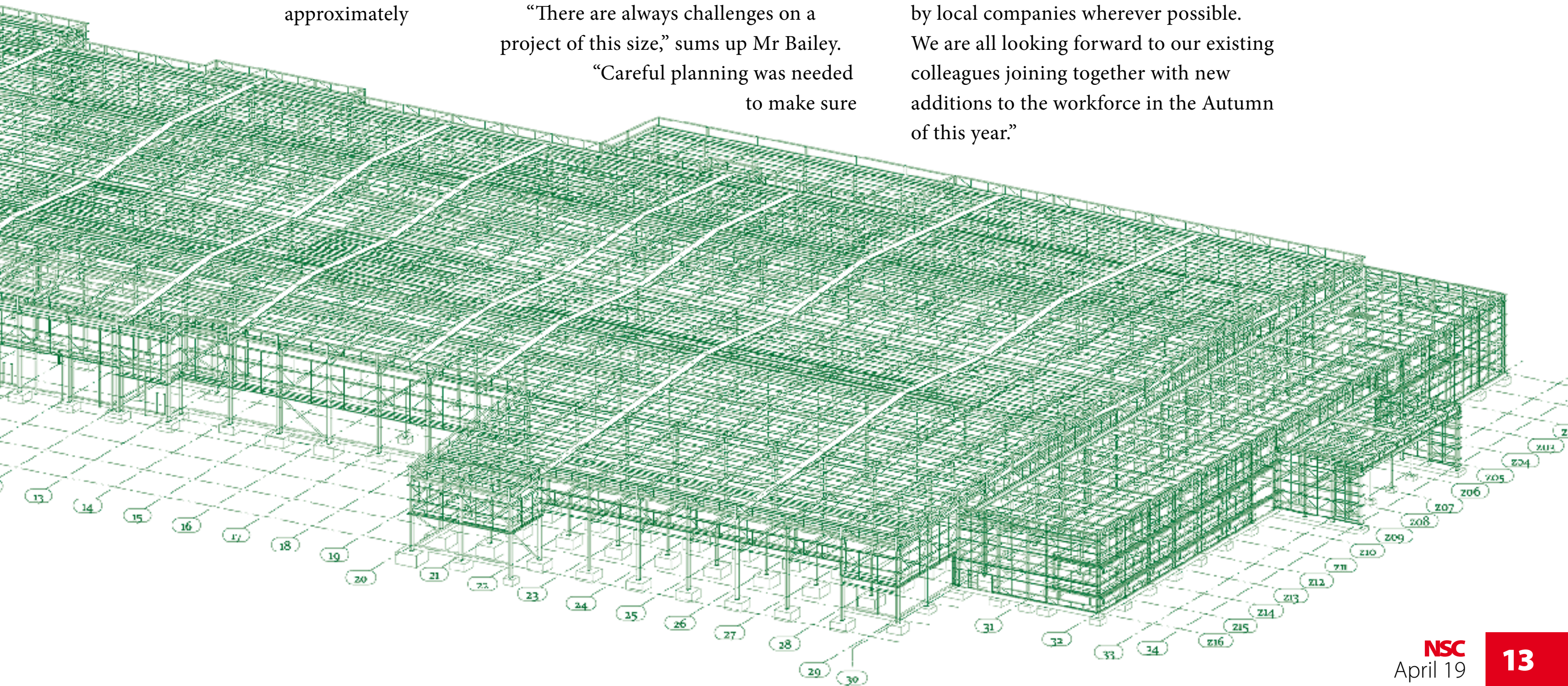
"There are always challenges on a project of this size," sums up Mr Bailey. "Careful planning was needed to make sure enough steelwork was fabricated to ensure the initial 14-week build programme was achieved."

Cranswick Country Foods Group Engineering Director Graeme Watson adds: "We have forged a close working relationship with all of our contractors and suppliers.

"While A C Bacon are new additions to the contract supply base, they are definitely keepers. We have very tight time lines to adhere to and the team, including A C Bacon, have delivered on every front.

"Since acquiring Crown Chicken in April 2016, Cranswick has committed to ensuring work on the site is carried out by local companies wherever possible. We are all looking forward to our existing colleagues joining together with new additions to the workforce in the Autumn of this year."

The roof cladding commenced once steelwork was complete



The central mall leading to the cinema block

Town centre revival

Steel construction is playing a vital role in Rochdale's ambitious multi-million pound Riverside regeneration scheme. Martin Cooper reports.

FACT FILE
Rochdale Riverside
Main client: Genr8 in partnership with Rochdale Development Agency and Rochdale Council
Architect: tp Bennett
Main contractor: Willmott Dixon
Structural engineer: Curtins
Steelwork contractor: Hambleton Steel
Steel tonnage: 1,800t

Financial woes and the continuing rise of online shopping have forced numerous household names in the retail sector to close down in recent years, leading to grim forecasts about the viability of the traditional high street and town centre malls.

Whether the forecasts are correct, only time will tell, but a number of towns and cities up and down the country are still investing in new retail and leisure complexes, specifically designed to become destinations to regenerate town centres and woo shoppers.

An example is Rochdale Riverside, which forms one of the final parts of a £250M investment package, which has been transforming the town centre beyond all recognition since 2011.

Other schemes which have been delivered as part of this ambitious regeneration programme include a new customer service centre, a library and council building known as Number One Riverside (see NSC June 2012), the new Rochdale Leisure centre, Rochdale Sixth Form College, (recently rated outstanding by Ofsted), and the award-winning river re-opening project.

Rochdale Riverside includes 18,500m² of steel-framed retail and leisure accommodation, with approximately 24 new shops, restaurants and a six-screen cinema.

It is hoped that this £80M development, with a central pedestrian street as a key feature, will transform the retail and entertainment offering in the town and encourage further inward investment.

Main contractor Willmott Dixon took possession of the site at the end of February 2018 and has been busy mobilising and engaging sub-contractors, with around £21m likely to be spent with Greater Manchester companies over the course of the two-year build.

"The site had previously been occupied by a bus station which had been demolished before we came on site," explains Willmott Dixon Project Manager Andy Howarth. "Our first task was to remediate the entire site and then raise the ground level in order to guard against potential flooding from the nearby River Roch."

Because of the project's town centre location a number of logistical challenges have had to be overcome. Access to the site has been altered a few times to take into account neighbouring premises, while the road layout had to be redesigned.

A road originally crossed the site and this has been closed and ripped up, while another route, between the construction plot and the site compound has been maintained to allow access to the adjacent existing shopping centre.

"A huge amount of services, beneath the old road and serving our neighbours also had to be diverted," adds Mr Howarth.

Steelwork contractor Hambleton Steel was able to begin its erection programme late last summer, with the work split into three main phases to allow other trades to clad and fit out areas which would otherwise become inaccessible. The project's initial steel design was done by Curtins, but Hambleton Steel were later appointed on a design and build contract by Willmott Dixon.

Hambleton Steel subsequently value-engineered the steelwork, and incorporated a few design changes that had arisen because of various client wishes.

Overall, the Riverside scheme consists of five steel-framed structures, a three-storey cinema block, two retail blocks known as north and south which are separated by the pedestrian thoroughfare, a two-storey Marks & Spencer anchor store and a three-level car park.

In order to allow the site to be constructed in a sequential manner, Hambleton is erecting the steel in a west to east direction, starting at the point nearest

How Rochdale's latest town centre addition will look


The cinema and retail block south takes shape


One of the six cinema screens

to the existing retail outlets and finishing close to John Street, one of the town centre's busiest thoroughfares.

The three-storey cinema block was the first structure to be erected. This building will eventually accommodate retail outlets on the ground floor, leisure facilities on the first floor and the six acoustically-isolated cinema screens on the upper double-height level.

The structure also accommodates a ground level service yard, which has a floor level lower than the rest of the structure to allow it to have more headroom for delivery trucks.

Creating this column-free space is a series of five 17.5m-long × 1.5m-deep plate girders, each weighing 10t. Originally, these members were going to be trusses, but Hambleton changed them to plate girders as this was considered to be a more economic option.

The cinema is a braced structure that also relies on moment frames for its stability. The roof bracing is fabricated from UC sections, as these members are said to transmit less sound than tubular sections.

Adding some architectural interest to the cinema's façades, a number of cantilevering boxes protrude from various points around the structure.

"There is very little continuity around the cinema block's perimeter steelwork and the projecting boxes add to the complexity," says Hambleton Steel Designer Andrew Dobson.

"The boxes have been formed with cantilevering beams and where a stiffer option was needed we've used small trusses."

Separated by a movement joint, retail block south abuts the cinema forming one continuous 150m-long building. Similar to the opposite 115m-long north block, both retail structures are double-height spaces with the potential to be a two-storey structure with the addition of a mezzanine level.

The blocks are each subdivided into individual units, with three already containing first floor mezzanines. Highlighting steelwork's flexibility, the retail tenants can opt to keep their units as large double-height spaces or insert mezzanines at a later date or during the fit-out programme.

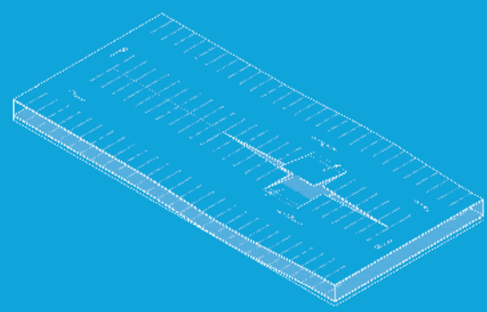
The Marks & Spencer anchor store measures approximately 50m × 50m and is a two-storey structure, containing 300t of steel, three precast staircases and three lift shafts.

Designed around a regular grid pattern, the majority of the anchor store's internal spans are 9m, allowing plenty of column-free retail space.

The final piece of the steel erection process will be the three-level car park (see box), which is due to begin this month (April) and complete by the end of May.

The Rochdale Riverside is scheduled to open in April 2020.

Multi-storey car park



Although Hambleton are fabricating and erecting this structure, it has been designed by specialist car parking consultants Hill Cannon.

The three-level structure will provide 522 parking spaces and has been designed around a standard 15.6m × 7.2m grid in order to provide unobstructed bays.

The access ramp system used is an internal vertical circulation module (VCM), which Hill Cannon says is a compact solution as it allows for more parking spaces within the footprint than a more traditional split deck system.

Within a VCM, each floor slopes to create a half height rise in its length, thereby necessitating shorter ramps between levels. The other half-height rise is created by the structure's cross ramp configuration, which actually means the floors are sloping in two directions. Each floor rises only 1:20 which complies with regulations for the disabled and offers a relatively flat level with full pedestrian access.

"Composite beams are used throughout as they are more economical," says Hill Cannon Senior Engineer Peter Matthewman. "They support a metal decked flooring system which has financial benefits over other floor systems and is consequently becoming a popular solution in car parks."

Steel erection under way on the leisure block

The right time for steel

In the second of our retail and leisure based regeneration projects, Martin Cooper reports from Time Square in Warrington.

The market hall's roof will feature a centrally-positioned roof light

Warrington is perhaps best known for its Rugby League team, the Wolves, one of the founding members of the Northern Rugby Football Union in 1895 and the only one that has played every subsequent season in the top flight.

However, the town has plans to become a retail and leisure destination, no mean feat when you consider the proximity of Liverpool and Manchester, both of which are only 20 miles away.

The town already has a major draw card in the shape of its award-winning market that dates back to medieval times, and which was recently voted the nation's best small indoor market.

It is currently housed in a temporary building, erected so that the original structure could be demolished to make room for a brand new hall.

The new market hall forms one part of the new Time Square development, a £110M mixed-use scheme, which will eventually help Warrington Borough Council realise its plans to regenerate a large swathe of the town centre.

Overall, the Time Square development consists of four steel-framed buildings, a leisure block accommodating retail and restaurant outlets on the ground floor and a 13-screen cinema complex above, a four-storey 9,200m² council office, a two-storey retail block and the new 60m × 40m market hall.

Steelwork contractor James Killelea has erected 3,000t of steel for the project, a total which equates to more than 6,500 individual pieces. The upper floors have all been formed compositely, with steel beams supporting metal decking and a concrete topping.

The steel erection programme began with the leisure block, as main contractor Vinci Construction continued with site remediation on the remainder of the site.

The leisure block measures 95m × 55m and has a height of 28m. The ground floor, which will accommodate retail and restaurant units, is a double-height space with plenty of room for optional mezzanine levels.

A complex steel design has been utilised in the leisure block as the ground floor column pattern does not fit well with the upper level's cinema.

The retail units are typically 10m-wide × 35m-deep clear spaces with no internal columns. To the rear of these units there is another column-free space accommodating a service yard, while numerous service areas and connecting corridors further limit the opportunity for column positions.

"Only about 30% of the columns in this building continue all the way up as the cinema requires a larger and more irregular column pattern to accommodate the 13-screens," says Alan Johnston Partnership Partner John Murphy.

"Consequently, we have a series of 15m-long transfer beams, dividing the building at first floor cinema foyer level, that allow the upper floors to have different column positions."

The cinema design incorporates a central spine of three floors to provide access and projection levels, while storey-high trusses have been used to transfer load to available support positions and limit beam depths where there is a restricted height.

The 13 screens vary in size, adding to the steelwork's complexity, while each one had to be acoustically isolated.

A number of design measures were undertaken to make sure the screens were adequately isolated. The building is a large braced frame, gaining its stability from bracing located around lifts shafts and stair cores and in the roof. The latter bracing elements could not use hollow sections as these members are not suitable for acoustics.

Also, in the structure's roof the purlins had to sit on half cleats to prevent sound travelling between the screens at this high level, while all of the building's column splices have used countersunk bolts to create a flush surface to aid the installation of acoustic boards.

"We also formed joints in the concrete slabs beneath the acoustic walls to prevent sound traveling through the floors," adds Mr Murphy.

Image: Leach Rhodes Walker

The scheme is centred around a new public realm

Once the 1,600t of steelwork for the leisure block had been completed, the remediation and ground works had also been concluded and James Killelea's erection team were able to move across the site and begin work on the offices, market hall and the small 61m × 18m retail block.

The four-storey office building is a skewed horseshoe shape in plan, with a centrally-positioned full-height atrium. It is approximately 72m-long and will offer 9,200m² of floorspace.

Using braced cores for its stability, the office has been designed for maximum internal column-free space and features 15m spans throughout.

All of these long spans have been formed with Westok cellular beams that also accommodate all of the building's services within their depth.

A service yard sits below one area of the office, adjacent to the entrance of the basement level that covers the entire footprint of the adjacent market hall.

A 22.5m-long × 1.8m-deep plate girder forms the column-free space and supports four-storeys of office structure above. This one steel member represents the largest single steel element on the entire project.

A retained Victorian façade has been incorporated into the design of the new market hall, along its main Bridge Street elevation. The façade previously belonged to a Boots store and formerly accommodated a plaque remembering the tragic IRA bombings which occurred on the spot in March 1993. The plaque has been temporarily removed by Vinci and will be returned to its location once the scheme is complete.

The retained façade was temporarily supported by a scaffold system, which was systematically released once the connected market hall steel frame was completed.

The market hall measures 60m × 40m and features first floor mezzanine levels around two sides, while the central column-free area of the structure is formed by a series of 27m-long lattice trusses.

The roof trusses also support a feature roof light that will allow natural light to penetrate the inner parts of the hall.

This structure is a braced frame that makes use of Macalloy cross bracing, which will be left exposed within the completed building as architectural features.

Summing up, Vinci Construction Senior Project Manager Paul Turner says: "The whole scheme lends itself to steel construction as the leisure block has a very complex design and would have been difficult to build with any other material, while the office and market hall both have long spans, which are easier and quicker to construct with steel."

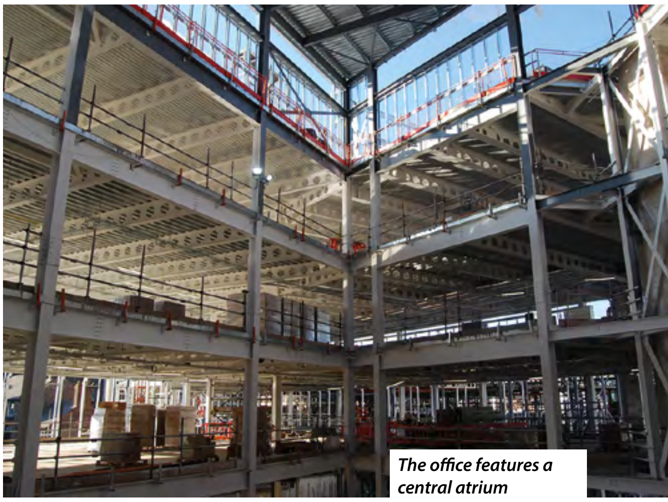
In conclusion, Warrington Council Head of Development John Laverick says: " The use of steel gives great confidence that the programme is going to be met, which is of critical importance in a commercial scheme such as this."

Time Square is scheduled to open in early 2020.

FACT FILE

Time Square, Warrington

Main Client: Muse Developments
Architect: Leach Rhodes Walker
Main contractor: Vinci Construction
Structural engineer: Alan Johnston Partnership
Steelwork contractor: James Killelea
Steel tonnage: 3,000t



The office features a central atrium

A large plate girder supports four storeys above a service yard

Capital regeneration

Numerous column grid patterns, requiring hundreds of tonnes of transfer structures, are helping to create a large retail-led mixed-use scheme in central Edinburgh.

FACT FILE
Edinburgh St James
Main client: Nuveen
Architect: BDP
Main contractor: Laing O'Rourke
Structural engineer: Arup
Steelwork contractor: BHC
Steel tonnage: 15,000t

One of the most significant construction and regeneration projects currently under way in the UK, and the largest city centre development Edinburgh has seen for decades, is dramatically altering a large part of the Scottish capital.

Known as Edinburgh St James, the £1bn project is replacing a 1960s shopping centre with 79,000m² of new retail space, anchored by an existing John Lewis store, a five-star W Hotel, an aparthotel, 152 prime residential apartments, more than 30 restaurants and the city's first Everyman Cinema.

The completed development will help Edinburgh climb the UK retail rankings from 13th to number eight, while potentially, the scheme could help the city's tourism spend - it is the UK's second most visited city after London - increase by 42%.

Work on this large city centre scheme, which is close to Waverley railway station, began in late 2016, with an 18-month demolition phase of the existing buildings.

The John Lewis anchor store sits adjacent to the site and continues to remain open throughout the construction programme. It is being enlarged as part of the scheme, with a new steel-framed extension, while the main existing parts of store will be fully-integrated into the new retail offering.

The store has provided one of the main challenges for the construction programme as part of its footprint covers the site's basement car park.

More than 380,000m³ of earth has been dug out to form the three-level car park that covers the entire site's footprint. But in the area beneath John Lewis, a temporary works programme was undertaken prior to this part of the dig.

Some of the store's concrete columns had to be removed and the floorplates temporarily propped, so the subterranean levels could be excavated. A total of nine new steel replacement columns, measuring 12m in height and each weighing 10t, will be installed. This will involve a tricky jacking process to be undertaken, as the floorplates need to be temporarily supported on trestles, to allow the new steelwork to be installed.

Once the new columns are installed the trestles will be removed, with jacks placed at each column location.

Adding some more complexity to the scheme, the cinema block will be positioned above the main John Lewis store, supported on existing concrete columns that extend up to level five. Above these columns, a series of 3m-deep steel trusses will support the cinema and its own unique column grid pattern.

The two lowest levels of car parking have

The main retail mall, which sits above a car park, takes shape

The completed scheme is centred around the egg-shaped W Hotel

Temporary works support the John Lewis floorplates until new steel columns are installed

been formed with in-situ concrete, but from there upwards the scheme, in its entirety, is using a steel-framed solution.

The third level of car parking is formed with steel columns, which are founded directly on to concrete columns, and steel beams supporting metal decking and a concrete topping. The majority of the project's floors from this level upwards are formed compositely.

Overall, the scheme is one large steel frame sub-divided up by movement joints, most of which are located either side of the 20 bridges that span the main semi-circular retail mall. Numerous concrete cores provide the steel elements with their stability.

"A steel solution is an efficient design solution, as it requires a smaller and more manageable workforce than other methods," says Laing O'Rourke Project Director Tim Kelly.

The car parking floors are all based around an 8.5m × 7.5m column grid pattern, but above this the spacing changes to a retail grid of 8m × 8m.

"Different grids have been used as each one is the optimum size for either car parking or multiple retail units that will be located over five levels," explains Arup Associate David Ferguson.

The retail grid is mostly the same throughout the scheme, but reduces in size slightly to suit the semi-circular shape of the mall and the irregular boundaries of the site.

The change of column spacings between the parking and retail levels has necessitated a raft of transfer structures to be installed at level one. These are generally 970mm-deep × 800mm-wide plate girders.

However, as BHC Project Manager Bobby McCormick explains, a more convenient option was also employed, wherever possible.

"We tried to swap as many plate girders as we could to off-the-shelf ArcelorMittal Histar sections, as they are cost-effective and require no fabrication.

"We managed to swap circa 1,000t, but there are still over 2,000t of plate girders used around the project."

The plate girders are not the largest steel members on the site, these are a series of 1,450mm-deep × 1,020mm-wide × 25m-long beams, each weighing 38t that form the main service yard.

Above the five levels of retail, the column pattern changes again to accommodate three floors of residential apartments. To allow the column spacing to decrease to a 5.5m × 3.3m grid pattern, transfer beams up to 840mm-deep are positioned on top of level five.

Further separate grid patterns are required for the project's two hotels. The Roomzzz aparthotel is positioned above one of the retail zones and will be constructed around a regular 6m × 6m rectangular spacing,

▶20

The smaller residential grid sits above the retail elements of the project

▶19

however the main five-star W Hotel is a different proposition.

To be erected around its own centrally-positioned concrete core, the W Hotel will be 13-storeys high and sits on a separate grillage of transfer beams positioned at level one.

The building is an egg-shaped structure, formed with radial floor beams creating a column spacing which is 4.8m at its widest. Adding to its complex design, the lowest three floors are inclined with raking columns, while the upper three are set-back, forming large terraces.

To create this complex-shaped structure, BHC will use a combination of facetted and curved steel members to form the balconies and perimeter walls.

As of March 2019, BHC had erected approximately one-third of the overall 15,000t of steel, a total that amounts to the company's largest ever project. The steelwork package is due to complete in June 2020, with the project opening in phases, beginning with the retail and leisure element anticipated to complete in 2020, and the remainder of the development in late 2021 when the W Hotel and residential parts will be ready.

The increasing use of S460 steel in buildings

David Brown of the SCI comments

Twenty five years ago, designers were being encouraged to use S355 (known as Grade 50 then) rather than S275 (Grade 43). In a similar way today, the use of S460 offers benefits as demonstrated by its use in the Edinburgh St James project.

The major structural advantage is seen in the design of compression members, where a higher column buckling curve is specified for S460. In the minor axis, which is generally critical, the buckling curve improves from curve 'c' to curve 'a' for a typical column section. There is a minor disadvantage because the non-dimensional slenderness increases with design strength, but this is more than offset by the improvement in buckling curve and the 30% increase in design strength. For typical column lengths in multi-storey buildings, the increase in resistance by using S460 can be in the order of 35 – 40% compared to S355. Smaller, lighter column sections can therefore be used.

In bending, the increase in resistance is solely due to the increased strength, offset very slightly by the increased slenderness if the member is unrestrained.

The Edinburgh St James project used S460 HISTAR. This steel is not covered by BS EN 10025, but by a European Technical Assessment (ETA), number 10/0156. The ETA can be found on the EOTA website by searching for the ETA number.

An ETA is an alternative to a harmonised Standard, and in this case tabulates the same mechanical, chemical and toughness properties as BS EN 10025, but specifically for HISTAR steel. The special feature of HISTAR steel is that the design strength for S460 does not reduce until the thickness is greater than 100 mm. There are no reductions at 16, 20, 63, 80 mm that would normally be anticipated – the design strength to be used in calculation is 460 N/mm² until the thickness exceeds 100 mm. Above 100 mm, the design strength drops slightly to 450 N/mm².

For relatively thick sections, the use of HISTAR would lead to an increase in resistance of around 15%, simply because there is no reduction in the design strength.

Designers should not be concerned about welding S460. The key measure of weldability is the carbon equivalent value (CEV). Table 4 of BS EN 10025-4 shows that the CEV for S355 up to 120 mm is 0.45, and for S460 is 0.48 (so not a significant increase). From Table 5 of ETA 10/0156, S460 HISTAR has a maximum CEV of 0.43 indicating that welding should not be more difficult with the higher grade.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Neptune, the Roman god of freshwater and the sea is the counterpart of the Greek god Poseidon.
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Champagne design

Hambledon is said to be the UK's oldest vineyard

Martin Cooper reports from a Hampshire vineyard that is expanding its facilities with a steel-framed wine cellar.

FACT FILE
Hambledon Vineyard, Hampshire
Main client: Hambledon Vineyard
Architect: Masser Architects
Structural engineer: Andrew Waring Associates
Steelwork contractor: Builders Beams
Steel tonnage: 200t

If one was listing famous winemaking regions of Europe, you would perhaps mention Champagne, Burgundy, Bordeaux or Tuscany, but the South East of England would probably not be one of your initial geographical choices.

However, this perception could be an error, as English wines, and in particular the sparkling variety, have in recent years secured growing worldwide recognition by winning some of the most prestigious awards and trophies in international competitions.

According to the latest data from Wine GB, the amount of vineyard acreage in the UK has grown by 150% in the last 10 years and tripled since the turn of the century.

Approximately 75% of this total (4,749 acres) is in the South East and the sparkling varieties of grape, Pinot Noir, Chardonnay and Pinot Meunier account for 71% of all grapevines planted.

"The chalky sub-strata of the South Downs are identical to that of the Champagne region of northern France and so this part of England has the right conditions and climate to produce some the best multi-vintage sparkling wines," says Phillip Kellett of Hambledon Vineyard.

Located in the heart of Hampshire and in the village credited with being the cradle of modern cricket, the Hambledon Vineyard is said to be England's oldest commercial vineyard having been established in 1952.

Phillip's brother Ian bought the vineyard in 1999 and has since expanded the operation so that today it comprises over 200 acres. This is spread over a number of local sites with each one planted with the three grape varieties most commonly used in the production of sparkling wine. In 2018, the vineyard produced 300,000 bottles of English sparkling wine.

Not wishing to rest on its laurels, Hambledon Vineyard has plans for further expansion and part of this scheme involves the construction of a new wine storage cellar and visitor centre.

"We want to be able to store up to two million bottles," explains Phillip Kellett. "While the visitor centre will help improve our wine tasting and tour facilities, which is another important part of our business."

The two-storey building has been dug into a chalk hillside and consists of a lower level cellar and an upper floor that will house the visitor facilities and further wine storage space at the rear of the structure.

As the hillside topography slopes downwards from the back of the building, the cellar parts of the structure will be below ground, as the roof at the rear is at ground level. The front of the building meanwhile, protrudes out of the hill.

Partially burying the structure into the

Cut into a hillside, the cellar will hold two million bottles

Steel supports precast planks for the upper floor

hill has two advantages, firstly the wine bottles will be housed in a cool, humid subterranean basement, which is ideal, and secondly the building will be unobtrusive by blending into the landscape.

The majority of the structure is steel-framed, chosen for a number of reasons, but primarily for its speed of construction.

"The vineyard has a window when construction can take place so as not to interfere with the harvesting and bottling, which take place between October and December," says Andrew Waring Associates Engineer Nigel Challis. "Steelwork started in January and was complete by March, which allowed plenty of time for the other works to complete in this period."

According to Phillip Kellett, other reasons for choosing a steel-framed solution were cost and the strength of steel. On the upper floor, the bottles and their stillages will be exerting up to 100t per m^2 of loading onto the supporting beams.

The beams forming the first floor are a mixture of 254UC and 305UC sections, along with 457UBs.

The steel frame is founded on a concrete raft foundation which was cast directly on top of the chalk rock. The raft was installed once the large excavation process, was completed. The dig saw 10,000m^3 of chalk excavated and the majority of this overburden will be used as backfill once the building has been finished.

The steelwork is based around a fairly regular column grid pattern; most bays measure 6m-wide and the steel structure for the first level is 10 bays long × four wide. Stability is derived from cross bracing, positioned in bays along both main elevations.

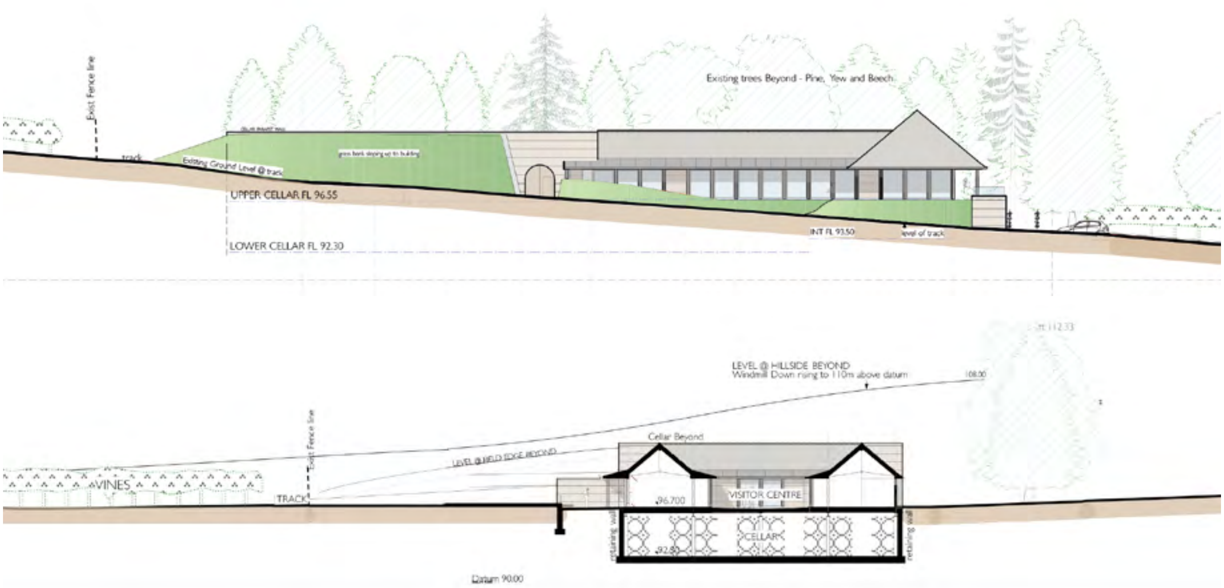
Steel beams support precast flooring planks with the aid of secondary beams placed at half points within each bay. Steelwork contractor Builders Beams installed these planks as well as precast wall units as part of its main steel erection programme.

The steel frame also incorporates an upper level cellar erected on the same grid pattern as below, but with a slightly lower floor-to-ceiling height of 4.5m, compared to 4.7m. The upper level steelwork only occupies the rear five bays, as the front portion of this floor will comprise a timber-framed visitor centre that will be supported on steelwork.

Not all of the steel frame accommodates wine storage as two rows of bays on the lower floor will house the building's main entrance, a wine tasting room, reception, meeting rooms, toilets and stairs.

Meanwhile, the upper level's timber visitor areas will be housed around an internal courtyard and will include a tea room, function and wine tasting room, a shop and offices.

The Hambledon Vineyard cellar and visitor centre is expected to be complete by early 2020.



The storage area is below ground, while the visitor facilities are above

Stability and second order effects on steel structures: Part 2: design according to Eurocode 3

Ricardo Pimentel of the SCI illustrates the different methods provided by EN 1993-1-1 to address the topics of member stability, global frame stability and second order effects. Fundamental structural mechanics relating to stability was covered in Part 1.

Section 5.2 of EN 1993-1-1[1] introduces an approximate method to calculate the critical factor of frames (α_{cr}), based on the well-known Horne method[2] (Figure 1). The method is limited to frames with low axial force in the beams/rafters ($N_{Ed} \leq 0.10\, N_{cr,R}$; N_{Ed} is the design axial load; $N_{cr,R}$ is the elastic critical load for buckling about the major axis of the beam/rafter) and for frames not steeper than 26°. For other cases, further guidance can be found in reference 3.

In section 5.2.2 of EN 1993-1-1, different methods are proposed to consider local (P-δ) and global (P-Δ) second order effects for structural analysis and member verifications. The following three main methods can be identified:

Method 1:
Both P-δ and P-Δ effects in addition to local and global imperfections are directly considered in the global analysis; the deformed structural shape is considered in the analysis, due to local and global imperfections and local and global second order effects; second order design internal forces are calculated. This design method may need to include in-plane and out of plane flexural buckling in addition to lateral torsional buckling.

Method 2:
P-Δ second order effects and global imperfections are considered in the structural analysis; P-δ effects are allowed for while performing stability checks according to EN 1993-1-1 section 6.3; the deformed structural shape is considered; second order design internal forces are calculated.

Method 3:
Both P-δ and P-Δ effects are accounted for when performing stability checks according to section 6.3 of EN 1993-1-1. In this method, an equivalent member length (effective length) needs to be defined. The allowance for P-Δ effects is made by increasing the P-δ effects by means of a longer member length. First order internal forces are considered for the member verification, which may include global imperfections – see EN1993-1-1 5.3.2 (4). Global imperfections need to be included in the analysis, generally by applying the Equivalent Horizontal Forces (*EHF*). Buckling lengths greater than $2l$ may be required to allow for P-Δ effects in structures sensitive to those effects.

For **Method 1**, different approaches may be taken, as out-of-plane flexural buckling (FB) and lateral torsional buckling (LTB) may or may not be relevant. To allow for LTB, according to EN 1993-1-1 section 5.3.4, an equivalent bow imperfection equal to $k{\cdot}e_{0,d}$ may be used, where $e_{0,d}$ is the equivalent bow imperfection of the weak axis of the profile and k is a correction factor; it is also stated that in general, torsion imperfections need not to be considered. According to the UK National Annex[4], the value of k is to be taken as 1. The application of Method 1 is more often used in research, but several commercial software packages already allow users to directly consider the P-δ and P-Δ effects within the structural analysis. Method 1, where local and global imperfection are directly considered in the analysis, is necessary for the cases where the following condition are met (clause 5.3.2 (6) of EN 1993-1-1):

- $\alpha_{cr} < 10$, for elastic global analysis;
- At least one moment resisting joint at one member end;
- $N_{Ed} > 0.25\, N_{cr,0}$, where N_{Ed} is the design axial load and $N_{cr,0}$ the critical load assuming a pin-ended strut. This means that for a simple column system, $\alpha_{cr} = \dfrac{N_{cr,o}}{N_{Ed}} < 4$.

Method 2 can be implemented by two possible approaches:

- Method 2.1 - Considering the P-Δ effects directly through a numerical geometric non-linear global analysis considering global imperfections; usually computed by commercial software packages; this may increase the required analysis time for large frames and multiple load combinations;
- Method 2.2 – Considering the P-Δ effects indirectly by amplifying the first order sway effects (including global imperfections) by the so-called amplification factor $k_{sw} = \dfrac{1}{1\text{-}1/\alpha_{cr}}$. As introduced in Part 1[5], this method is limited to the cases where $\alpha_{cr} \geq 3$. For multi-storey buildings, the rule may be used when vertical and horizontal loads and frame stiffness are similar between storeys – see EN 1993-1-1 5.2.2 (6) B.

Both methods 2.1 and 2.2 are extensively used in practice. When verifying members according to EN 1993-1-1 section 6.3, system length should be used as the buckling length.

$$\alpha_{cr} = \left(\frac{H_{Ed}}{V_{Ed}}\right)\left(\frac{h}{\delta_{H,Ed}}\right)$$

H_{Ed} – Total storey shear;

V_{Ed} – Total vertical load at that storey;

h – Storey height;

$\delta_{H,Ed}$ – Horizontal displacement of the top storey relative to the bottom storey due to horizontal loads;

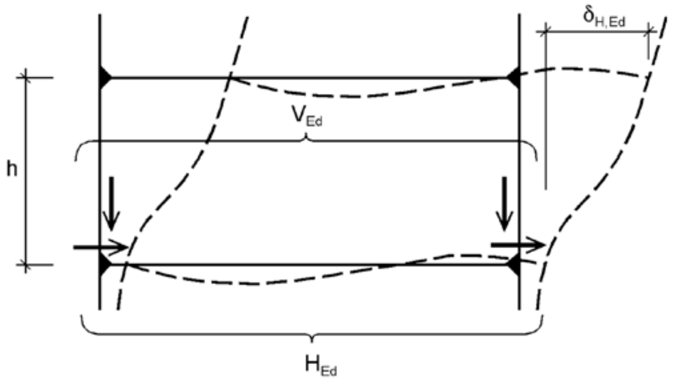


Figure 1 – Horne method to calculated α_{cr} of frames.

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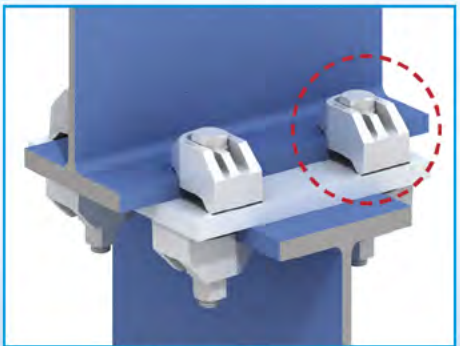

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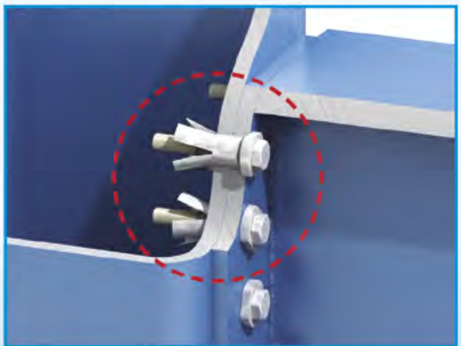

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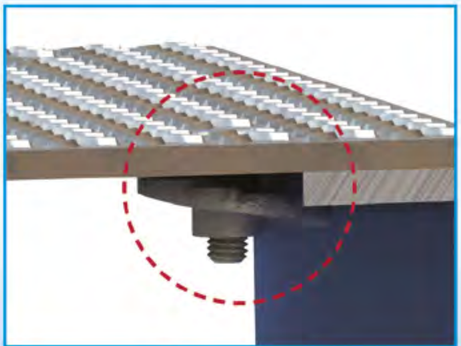

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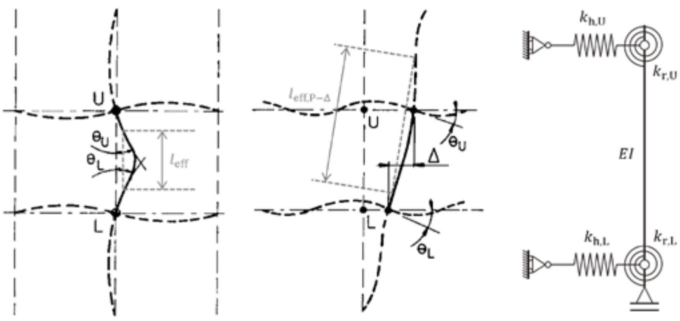
▶24 In **Method 3**, the designer must determine an appropriate effective length that allows for the consideration of *P-Δ* effects while performing member checks according to section 6.3 of EN 1993-1-1. As the design is based on first order internal forces, the complexity of the analysis is removed, but the effective length needs to be specified for each column. The concept of effective length was introduced in Part 1 of the current article for isolated struts, where the horizontal or rotational restraints of the strut ends were assumed as infinitely rigid. This does not represent reality: (i) rotational stiffness of the nodes is related to the flexural stiffness of the elements that are connected to the nodes, resulting in a rotational spring on each node – $k_{r,i}$ (Figure 2); (ii) if a structure is susceptible to second order global effects, the complexity is increased, as the structure is horizontally flexible (assessed by the value of α_{cr}), resulting in horizontal springs on each node – $k_{h,i}$ (Figure 2).

When a column is integrated in a frame, the concept of effective length may be described as the fictional pin-ended strut length that buckles at the same time as the frame for a specified load case[6]. Based on the value of α_{cr} for the entire frame, the critical load N_{cr} for each column can be calculated by multiplying the design axial load on each column by the value of α_{cr}. The effective lengths can then be obtained by a back calculation, knowing that $N_{cr}=(\pi^2 EI)/(l_{eff})^2$. Thus, the effective length of a column is dependent on the applied load and spring stiffness at the nodes. The values of l_{eff} obtained are only appropriate within the load arrangement assumed to calculate α_{cr}. This method is described in Annex E.6 of BS 5950-1[7].



a) Non-sway frame[8] $\alpha_{cr} \geq 10$ for elastic global analysis

b) Sway frame[8] $\alpha_{cr} < 10$ for elastic global analysis

c) Equivalent isolated column model

Figure 2: Effective length concept in sway and non-sway frames

In practice, while using **Method 3**, the definition of the effective buckling length is often obtained indirectly by a simplified analysis where each column is considered individually, with no dependency on the applied load. There are several resources to assess the problem, such as the well-known Wood method[9], which provides effective buckling lengths for sway or non-sway frames. These approximate methods are intended to provide an answer for the problem shown Figure 2c. The Wood method can be found in Annex E of BS 5950-1 as well as in NCCI SN008a[10]. Based on the model in Figure 2c, simplified methods usually assume that $k_{h,L} = \infty$ and $k_{h,U} = 0$[9].

The approximate methods provide exact results if every member has the same rigidity parameter $\varnothing_r = \sqrt{EI/N_{Ed} l^2}$ where *EI* is the flexural stiffness of the column, N_{Ed} is the design axial load on the column, and l is the system length of the column[6]. This means that all columns would buckle at the same time. The columns with low values of $\varnothing_r$ are the critical members (members which induce frame instability), for which the method gives conservative values of the buckling length. For members with high values of $\varnothing_r$, buckling lengths are unconservative. For the critical members, the method can be seen as a conservative approximation for the critical load of the frame[6].

The approximate methods provide an efficient and systematic procedure to assess the problem. However, the following effects/simplifications are usually disregarded/considered in the process[6,8,9,11,12]: (i) only columns are affected by *P-Δ* effects, while internal forces to design other elements (beams, connections) will be always based on first order theory; (ii) for frames sensitive to second order effects, the effective lengths calculated are the same for any value of α_{cr}; (iii) there is no influence of the applied load; (iv) for columns in non-sway frames, the rotation at opposite ends of the restraining elements are equal in magnitude and opposite in direction, producing single curvature bending; (v) for columns in sway frames, the rotation at opposite ends of the restraining elements are equal in magnitude and opposite in direction, producing double curvature bending; (vi) all columns buckle simultaneously; (vii) stiffness parameter $\varnothing_r$ is the same for all columns; (viii) no significant axial force exists in the beams; (ix) all joints are rigid; (x) joint restraint is distributed to the column above and below the joint in proportion to *EI*/*l* for the two columns. Further information about approximate methods can be found in reference 11.

Two worked examples follow, where the results obtained from the application of methods 2.1, 2.2 and 3 are compared.

Worked example 1: simple column

Influence of the number of finite elements on simple struts (Table 1):

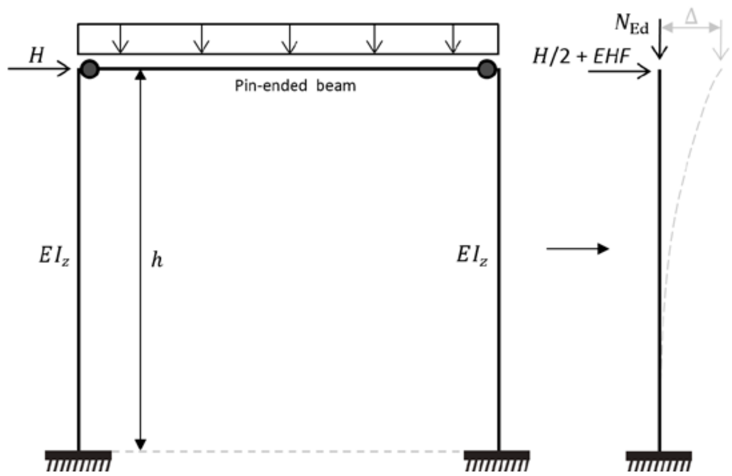
The results support the conclusions from Part 1: for low values of N_{Ed}/N_{cr} the errors in using an approximate stiffness matrix are less significant than for cases where N_{Ed}/N_{cr} is close to 4. The consideration of 3 finite elements for the strut gives reasonable results for the four cases.

The design of the column based on **Method 2** (2.1 by a numerical *P-Δ* or 2.2 considering k_{sw}) and **Method 3** will be undertaken for the structure in Figure 3. Two examples are considered for different levels of horizontal load. A comparison of the Unity factor (UF) for relevant checks according to EN 1993-1-1 is presented in Table 2.

From Worked Example 1, it can be noted that there is very close agreement in the utilization factor between methods 2.1 and 2.2. Method 3 is conservative for N_{Ed} = 75 kN and $H/2$ = 10 kN. If the horizontal load $H/2$ is increased to 20 kN, Method 3 becomes unconservative.

Boundary conditions	Section	l [m]	Theoretical value of $N_{cr,z}$ [kN]	$N_{cr,1}$ 1 FE	$N_{cr,3}$ 3 FE	$N_{cr,5}$ 5 FE	$N_{cr,10}$ 10 FE
Cantilever	254 UC 107	10	$N_{cr,z}=\frac{\pi^2 EI}{(2l)^2}=307.16$	309.47	307.19	307.17	307.16
Pinned Pinned	254 UC 107	10	$N_{cr,z}=\frac{\pi^2 EI}{l^2}=1228.65$	1493.86	1230.59	1228.91	1228.66
Pinned Fixed	254 UC 107	10	$N_{cr,z}=\frac{\pi^2 EI}{(0.6992l)^2}=2513.18$	3734.64	2528.93	2515.68	2513.64
Fixed Fixed	254 UC 107	10	$N_{cr,z}=\frac{\pi^2 EI}{(0.5l)^2}=4914.59$	∞*	5022.36	4930.35	4915.65
* - See Part 1[5], Figure 8; this example represents $N_{Ed}/N_{cr}=4$);							

Table 1: Buckling analysis of a strut considering different number of finite elements (FE)[13]*.*



$h = 10$ m;
Columns: 254 UC 107; $I_z = 5928$ cm^4; Steel: S355 JR
$N_{Ed} = 75$ kN; Example 1.1: $H = 20$ kN;
Example 1.2: $H = 40$ kN (factored loads)
EN 1993-1-1 section 5.3.2:

$$EHF=\frac{1}{200}*75=0.375 \text{ kN}$$

$$N_{cr}=\frac{\pi^2 EI_z}{(2l)^2}=307.16 \text{ kN}$$

If the system is represented by a single column:

$$\alpha_{cr}=\frac{N_{cr}}{N_{Ed}}=\frac{307.16}{75}=4.10$$

As $\alpha_{cr} > 4$, local bow imperfections can be disregarded in the analysis – EN 1993-1-1 5.3.2 (6).

$$k_{sw}=\frac{1}{1\text{-}1/\alpha_{cr}}=\frac{1}{1\text{-}1/4.10}=1.32$$

Figure 3: Example of a slender simple column.

Worked example	Method	l_{eff} [m]	N_{Ed} [kN]	$H/2 + EHF$ [kN]	First order bending moment [kNm]	Second order bending moment [kNm]	UF
1.1	2.1	10	75	10.375	103.75	131.29	0.53
	2.2	10	75	10.375	103.75	103.75 * 1.32 = 136.95	0.55
	3	20	75	10.375	103.75	-	0.63
1.2	2.1	10	75	20.375	203.75	257.77	1.04
	2.2	10	75	20.375	203.75	203.75 * 1.32 = 268.95	1.09
	3	20	75	20.375	203.75	-	0.96

Table 2: Results for two different load arrangements: simple column[13]*.*

Worked example 2: three-storey frame

In worked example 2, the comparisons are extended to a three-storey frame (shown in Figure 4). Geometric conditions can be found in Table 3. Two examples are considered for different levels of horizontal load. Comparisons of the Unity factor (UF) for relevant checks according to EN 1993-1-1 are presented in Table 4 and Table 5 for the two horizontal load arrangements.

The effective buckling lengths were obtained by a back-calculation based on the global buckling mode of the frame. Example for Model 4:

$$N_{cr,AB} = \alpha_{cr}\, N_{Ed,AB} = \pi^2\, EI_{z,AB}/(l_{eff,AB})^2 \;\text{ so, }\; l_{eff,AB} = \sqrt{\frac{\pi^2 EI_{z,AB}}{5.87 * 4055.47}} = 4.23\text{ m}$$

Note: this process was adopted to obtain as much precision as possible in the comparison between the methods. It should be highlighted that the back-calculation method based on α_{cr} is only valid for the considered load arrangement. Conservative results for the effective lengths are expected when using approximated methods which are valid for any load arrangement.

The numerical consideration of global *P-Δ* effects and the approximate consideration of those effects with the amplification factor show a very close agreement in the utilization factor (as for worked example 1). The effective length method still gives a reasonable answer in comparison to the other two methods, but differences around 0.15 in the utilization factor (conservative or non-conservative) can be obtained.

Model	Bases	Beams	Columns	I_z [mm^4]	S [m]	h_1 [m]	h_2 [m]	h_3 [m]	$0.25N_{cr,0,AB}$ [kN]
1	Pinned	UB 457 191 161	UC 356 406 551	82670	10	3.75	3.00	3.00	30461.02
2	Pinned	UB 457 191 161	UC 356 406 340	46850	10	4.00	3.20	3.20	15172.20
3	Fixed	UB 457 191 161	UC 356 406 235	30990	10	5.00	4.00	4.00	6423.04
4	Fixed	UB 457 191 161	UC 356 368 177	20530	10	5.00	4.00	4.00	4255.08

Vertical loads on each story (unfactored): self-weight; permanent loads: 50 kN/m; imposed loads: 35 kN/m;
Horizontal loads: Example 2.1: $H = EHF$; Example 2.2: $H = EHF + 100$ kN (imposed load, unfactored) on each storey;
EHF: $\emptyset = 1/200$; Column spacing: 10 m; $h_1/h_2 = h_1/h_3 = 1.25$); Material: S355 JR;
Columns under minor axis bending; Beams under major axis bending; 10 Finite elements per member;
The solution for Model 4 was configured to achieve $N_{Ed} > 0.25\, N_{cr,0}$ (clause 5.3.2 (6) of EN 1993-1-1).

Table 3: Models considered in worked example 2.

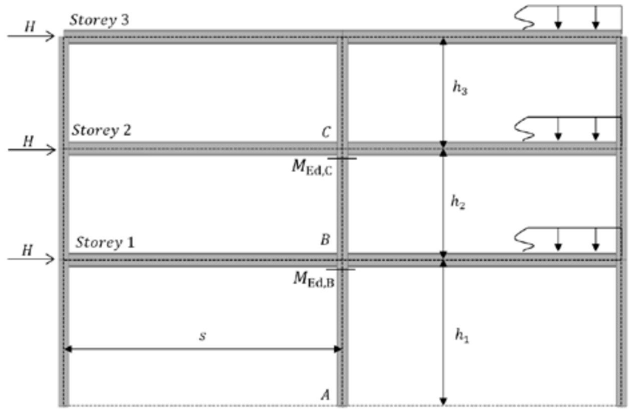


Figure 4: Geometry for worked example 2.

Note: in real design cases, perfectly fixed bases are not realistic. Nominally fixed bases may be assumed with the flexural stiffness of the base equal to the flexural stiffness of the column[7].

Model	α_{cr}	k_{sw}	Design method	$M_{Ed,B}$ [kNm]	$M_{Ed,C}$ [kNm]	$N_{Ed,AB}$ [kN]	$N_{Ed,BC}$ [kN]	$l_{eff,AB}$ [m]	$l_{eff,BC}$ [m]	UF_{AB}	UF_{BC}
1	7.33	1.16	2.1	60.84	33.60	3860.91	2549.80	3.75	3.00	0.21	0.13
			2.2	61.04	34.85	3860.53	2549.54	3.75	3.00	0.21	0.13
			3	52.62	30.04	3860.53	2549.54	7.78	9.58	0.30	0.24
2	4.42	1.29	2.1	70.66	33.19	3906.91	2585.93	4.00	3.20	0.36	0.21
			2.2	72.01	36.34	3906.07	2585.50	4.00	3.20	0.36	0.22
			3	55.83	28.17	3906.07	2585.51	7.50	9.22	0.49	0.39
3	8.25	1.14	2.1	35.71	26.90	3989.55	2645.51	5.00	4.00	0.52	0.32
			2.2	35.93	27.84	3988.02	2644.78	5.00	4.00	0.52	0.32
			3	31.52	24.42	3988.02	2644.78	4.42	5.43	0.49	0.36
4	5.87	1.21	2.1	38.17	26.49	4057.78	2693.40	5.00	4.00	0.64	0.40
			2.2	39.00	28.35	4055.47	2692.36	5.00	4.00	0.64	0.40
			3	32.23	23.43	4055.47	2692.37	4.23	5.19	0.66	0.49

Table 4: Worked example 2.1: horizontal loads with only EHF[13].

Model	α_{cr}	k_{sw}	Design method	$M_{Ed,B}$ [kNm]	$M_{Ed,C}$ [kNm]	$N_{Ed,AB}$ [kN]	$N_{Ed,BC}$ [kN]	$l_{eff,AB}$ [m]	$l_{eff,BC}$ [m]	UF_{AB}	UF_{BC}
1	7.31	1.16	2.1	821.33	453.69	3861.26	2549.73	3.75	3.00	0.48	0.26
			2.2	823.99	470.48	3860.86	2549.48	3.75	3.00	0.48	0.27
			3	710.34	405.58	3860.81	2549.49	7.79	9.59	0.55	0.36
2	4.41	1.29	2.1	953.98	448.26	3907.42	2585.94	4.00	3.20	0.87	0.41
			2.2	972.20	490.65	3906.37	2585.45	4.00	3.20	0.88	0.43
			3	753.64	380.35	3906.29	2585.47	7.51	9.23	0.96	0.57
3	8.23	1.14	2.1	482.07	363.31	3990.08	2645.67	5.00	4.00	0.80	0.51
			2.2	485.11	375.79	3988.33	2644.74	5.00	4.00	0.81	0.52
			3	425.53	329.64	3988.29	2644.74	4.42	5.43	0.75	0.54
4	5.86	1.21	2.1	515.31	357.77	4058.47	2693.69	5.00	4.00	1.09	0.69
			2.2	526.53	383.70	4055.75	2692.33	5.00	4.00	1.14	0.71
			3	435.14	316.28	4055.70	2692.34	4.23	5.19	0.98	0.71

Table 5: Worked example 2.2: horizontal loads with EHF + 100 kN (imposed load, unfactored)[13].

a) Sway frame: 1 Finite element per member: $\alpha_{cr} = 5.94$

a) Sway frame: 10 Finite elements per member: $\alpha_{cr} = 5.87$

c) Non-sway frame: 1 Finite element per member: $\alpha_{cr} = 41.63$

d) Non-sway frame: 10 Finite elements per member: $\alpha_{cr} = 14.81$

Figure 5: Influence of the number of finite elements per member on frame stability[13].

Influence of the number of finite elements on frame stability:

The differences in modelling precision are demonstrated in Figure 5, which shows the different buckling modes and values of α_{cr} for models with 1 and 10 finite elements per member (using Model 4 from worked example 2.1). The non-sway frame has horizontal supports on each floor level.

Calculation of α_{cr} using the Horne method:

For model 4 of worked example 2.1, the calculation of α_{cr} according to clause Section 5.2 of EN 1993-1-1 is shown in Figure 6. The approximate value of 6.61 may be compared with the precise value of 5.87 from Table 4 and 5.86 from Table 5. The approximated value of 6.61 is the same for worked examples 2.1 and 2.2, as the ratio $H_{Ed}/\delta_{H,Ed}$ is identical in the method.

$$\alpha_{cr,story\,1} = \left(\frac{3*12}{3*2400}\right)\left(\frac{5}{0.00378}\right) = 6.61$$

$$\alpha_{cr,story\,2} = \left(\frac{2*12}{2*2400}\right)\left(\frac{4}{0.00587-0.00378}\right) = 9.57$$

$$\alpha_{cr,story\,3} = \left(\frac{H_{Ed}}{2400}\right)\left(\frac{4}{0.00692-0.00587}\right) = 19.04$$

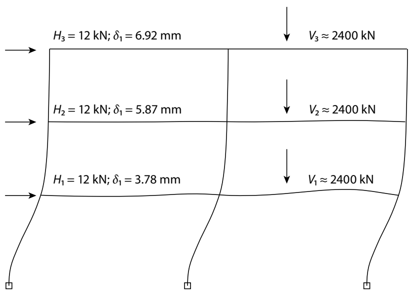


Figure 6: Calculation of α_{cr} with the Horne method (worked example 2.1)[13].

Conclusions

1 Eurocode 3 provides essentially 3 different methods to consider local and global second order effects when verifying members;
2 In practice, local second order effects are usually considered when checking member stability according to section 6.3 of EN 1993-1-1;
3 Local imperfections may need to be considered for global analysis; this may be mandatory according to clause 5.3.2 (6) of EN 1993-1-1; the criteria is more significant for frames with fixed bases where lower α_{cr} can be obtained with slender members;
4 The effective length method considers the effects of global second order effects by increasing the local second order effects; buckling lengths greater than 2*l* may be required;
5 The numerical consideration of global *P-Δ* effects and the approximated consideration of those effects with the amplification factor give very similar results; For member stability verifications according to section 6.3 of EN 1993-1-1, system lengths should be used;
6 The effective length method gives a reasonable answer in comparison to the other two other methods where second order internal forces are calculated. Differences between methods can be up to approximately 0.15 in the utilization factor (conservative or non-conservative); differences are less significant for higher values of α_{cr}.
7 The importance of considering more than 1 finite element per member was demonstrated for struts and frames. At least 3 finite elements are recommended;
8 Horizontal loads have a small influence in the values of α_{cr}.

References

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2 An approximate method for calculating the elastic critical load of multi-storey frames; M. R. Horn; The Structural Engineer, 53, 1975.
3 Eurocode 3 and the in-plane stability of portal frames; Lim, J.B.P., King, C.M., Rathbone, A.J., Davies, J.M. and Edmondson, V.; The Structural Engineer, Vol. 83, No. 21, November 2005.
4 NA to BS EN 1993-1-1+A1 ; UK National Annex to Eurocode 3 - Eurocode 3 - Design of steel structures - Part 1-1: General rules and rules for buildings; BSI, 2014;
5 Stability and second order effects on steel structures: Part 1: fundamental behaviour; R. Pimentel, New Steel Construction; Vol 27 No 3 March 2019.
6 Stability and Design of Structures (in Portuguese); A. Reis, D. Camotim; Orion editions, 2012;
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8 Manual on Stability of Steel Structures; ECCS – European Conventional for Constructional Steelwork, 1976;
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11 The effective length of columns in multi-storey frames; A. Webber, J. J. Orr, P. Shepherd, K. Crothers; Engineering Structures 102 (2015) 132–143.
12 Structural steel design according to Eurocode 3 and AISC Specifications; C. Bernuzzi, B. Cordova; Wiley Blackwell, 2016.
13 Autodesk Robot Structural Analysis 2019.

AD 429:
Slip factors for alkali-zinc silicate paint

This AD note draws attention to the slip factors for alkali-zinc silicate painted faying surfaces considered in AD 383 which have been updated in the 2018 revision of BS EN 1090-2.

AD 383, which was published in September 2014, discussed the slip factor for surfaces coated with alkali-zinc silicate paint and the significant influence of the coating thickness. The AD referred to forthcoming changes to Table 18 of BS EN 1090-2, expected to reflect concerns about the relationship between the coating thickness and slip factor. In the interim, AD 383 proposed slip factors of 0.3 (if certain recommended practices were followed) or 0.2 as a conservative value.

BS EN 1090-2 was revised in 2018 and slip factors are presented in Table 17. For surfaces coated with alkali-zinc silicate paint, the nominal thickness is now specified as 60 µm, with a dry film thickness between 40 µm and 80 µm.

If the applied coating meets the thickness limits specified in Table 17, a slip factor of 0.4 may be assumed. AD 383 noted that in practice the coating thickness can often exceed 80 µm, so coating procedures will need to be carefully controlled and the dry film thickness measured, to ensure the limits in Table 17 are satisfied. If such control is not practical, then the conservative slip factors quoted in AD 383 may be adopted.

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New and revised codes & standards

From BSI Updates March 2019

BS EN PUBLICATIONS

BS EN ISO 5817:2014 – Tracked Changes

Welding. Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded). Quality levels for imperfections
No current standard is superseded

BS EN ISO 17640:2018

Non-destructive testing of welds. Ultrasonic testing. Techniques, testing levels and assessment
Supersedes BS EN ISO 17640:2017

BS EN ISO 17640:2018 – Tracked Changes

Non-destructive testing of welds. Ultrasonic testing. Techniques, testing levels and assessment
No current standard is superseded

BS IMPLEMENTATIONS

BS ISO 19427:2019

Steel wire ropes. Pre-fabricated parallel wire strands for suspension bridge main cable. Specifications
No current standard is superseded

BRITISH STANDARDS UNDER REVIEW

BS EN ISO 2560:2009

Welding consumables. Covered electrodes for manual metal arc welding of non-alloy and fine grain steels. Classification

BS EN ISO 5817:2014

Welding. Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded). Quality levels for imperfections

BS EN 10088-4:2009

Stainless steels. Technical delivery conditions for sheet/plate and strip corrosion resisting steels for construction purposes

BS EN 10088-5:2009

Stainless steels. Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes

BS EN 10307:2001

Non-destructive testing. Ultrasonic testing of austenitic and austenitic-ferritic stainless steels flat products of thickness equal to or greater than 6 mm (reflection method)

BS EN 10343:2009

Steels for quenching and tempering for construction purposes. Technical delivery conditions

BS EN ISO 14341:2011

Welding consumables. Wire electrodes and weld deposits for gas shielded metal arc welding of non-alloy and fine grain steels. Classification

BS EN ISO 15610:2003

Specification and qualification of welding procedures for metallic materials. Qualification based on tested welding consumables

BS EN ISO 21670:2014

Fasteners. Hexagon weld nuts with flange

NEW WORK STARTED

EN 10210-3

Hot finished steel structural hollow sections. Technical delivery conditions for mechanical engineering purposes
Will supersede BS EN 10210-2:2006

EN 10219-3

Cold formed welded steel structural hollow sections. Technical delivery conditions for mechanical engineering purposes
Will supersede BS EN 10219-2:2006

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

19/30344253 DC

BS ISO 20887 Sustainability in buildings and civil engineering works. Design for disassembly and adaptability. Principles, requirements and guidance
Comments for the above document were required by 26 March, 2019

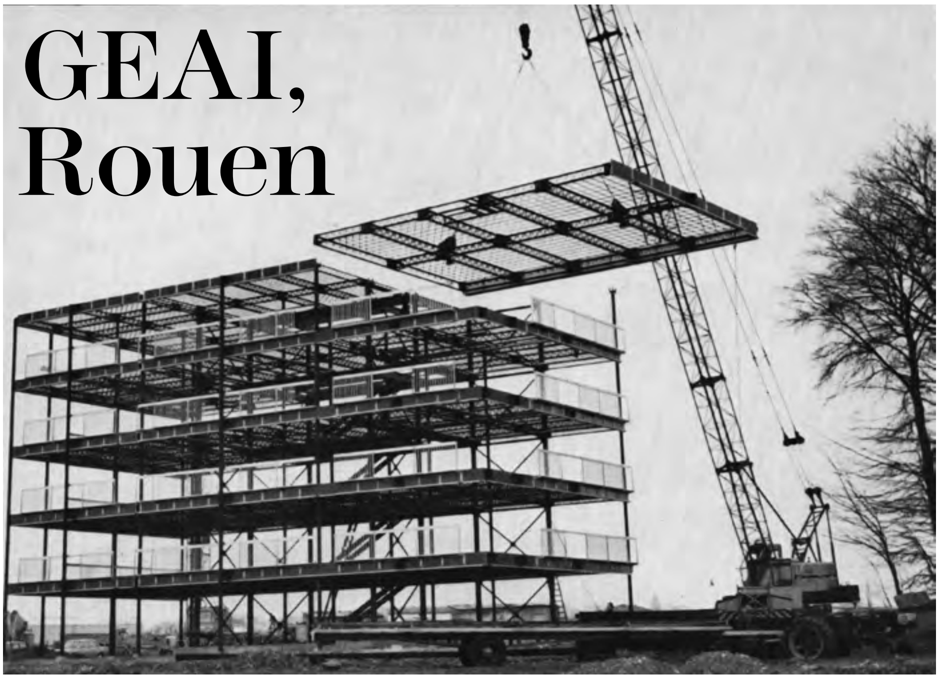
19/30376815 DC

BS EN ISO 23386 Building information modelling and other digital processes used in construction. Methodology to describe, author and maintain properties in interconnected dictionaries
Comments for the above document were required by 10 March, 2019

BUILDING WITH STEEL

Reprinted from Volume 5 No. 4
June 1969

GEAI, Rouen



Landing a section of the roof steelwork

Like many other highly industrialised nations, France has sought to solve its desperate housing problems by making use of prefabricated structures, in steel as well as in other constructional media. For this purpose various consortia have been established; one of them consisting of architects and industrialists, which was formed in 1962, is known as GEAI (Groupement pour l'Etude d'une Architecture Industrialisée). As a result of their investigations, GEAI were able to construct a prototype block of flats in Aubervillers early in 1966, the principal virtue of which was that a completely dry system of construction was involved above the foundations. Subsequently, a scheme for 500 flats, consisting of 25 blocks of 20 dwellings, was prepared for a site in Rouen, the scheme being known as 'Grand'Mare III'. It is the object of this article to describe the salient features of this project which is now rapidly nearing completion and has been the subject of a recent visit by representatives of the European Convention of Constructional Steelwork Associations, including the BCSA.

Structural elements

As will be observed from the accompanying photographs, the elements erected on the site are comparatively few in number. The loads are carried by steel columns and an unusual floor and roofing system comprising components which are reminiscent of mattresses. These

Welding the infilling for a GEAI mattress

mattresses consist of three-dimensional latticed frames, 300 mm deep, formed into panels based on a 900 mm square module, typical sizes on plan being 3.600 m × 2.700 m, 4.500 m × 2.700 m and 5.400 m × 2.700 m. Within the blocks there are steel staircases, but provision could be made for lifts.

The floors comprise thin concrete slabs and the ceilings, interlocking chipboard panels. Dry partitions, either permanent or temporary, are used, together with prefabricated wall panels, balcony balustrading, joinery and blinds. It is interesting to note that all the main elements have been subjected to fire tests, with completely satisfactory results.

The most original item in the GEAI system is undoubtedly the floor mattress. As will be seen in the photographs taken in the fabrication shops in Rouen, the standard panels comprise top and bottom grids, made from 10 mm round bars at 300 mm centres in both directions.. These grids are staggered by 150 mm in both directions with respect to one another in order to accommodate the 8 mm lacing bars providing the infilling.

A view of a completed façade of a GEAI block

The main framework around the mattress consists of four lattice girders comprising angle chords and flat web members. All the units are interchangeable as they are accurately fabricated in jigs. There are also special panels to allow for the passage of vertical ducts, etc.

A particular feature in the Grand'Mare III scheme is that the exposed steelwork is in Cor-ten weathering steel. To prevent any possible staining in the early stages of oxidation, the columns are offset from the façades by the insertion of special brackets.

Construction

The scheme occupies two adjacent sites where provision has been made for 100 three-room flats, 312 four-room flats and 88 five-room flats.

The twenty-five blocks are all five storeys high, the ground floor of each being limited to the entrance hall, a perambulator area, a dustbin store and the central heating unit. Nine blocks are isolated but the others are in groups of two or four.

Despite the fact that the weight of the GEAI structures is about one-quarter of that of traditional buildings of the same volume and for similar purposes, it was necessary to employ some piled foundations as the sub-soil conditions were not good. There are eight driven piles per block, 35 concrete bases and a lean-mix slab for the enclosed portions of the ground floor.

Apart from pile-driving equipment, the only vehicles on the site were lorries which delivered the components and mobile cranes which erected them.

Once the foundations and bases for a block of flats had been completed. It was possible to start erection. To ensure stability, braced panels are incorporated in the design as strong points. These units, consisting of two 180 mm deep column sections, 15 m high and spaced at 3.600 m centres, braced with channels and angles and completely fabricated in the shops, were the first components to be erected on the site where they were held in position in temporary guys until sufficient steelwork had been erected to make the structure stable in all directions.

The central parts of the blocks are reserved for vertical circulation and for the landings serving the flats. The landings and the corresponding portions of the roof were made from 5 mm thick plate and light joists.

This steelwork, which was shot-blasted and painted, together with the staircase steel, was the only steelwork not in Cor-ten.

On the site, the various mattresses were bolted edge-to-edge to make up the very large floor units which were hoisted by mobile crane as shown in the illustration. Once the steelwork had been erected it was possible to fix the partitions and cladding extremely quickly. In fact, the whole operation could proceed almost independently of the weather.

Acknowledgements

The architect responsible for the conception and development of the GEAI system is Marcel Lods. The BCSA also gratefully acknowledge the help given by the Compagnie Française d'Entreprises Métalliques (CFEA) who kindly supplied the photographs.

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, Marketing and Membership Administrator,
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, ● = Member)

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 & J Stead Ltd	01653 693742			●	●					●	●			●	●		3			Up to £400,000
A C Bacon Engineering Ltd	01953 850611			●	●	●	●				●			●			2			Up to £3,000,000
Access Design & Engineering	01642 245151					●				●	●			●	●	✔	4			Up to £4,000,000
Adey Steel Ltd	01509 556677	●		●	●	●	●	●	●	●	●			●	●	✔	3	✔	Silver	Up to £4,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●									✔	2	✔	Gold	Up to £3,000,000
Advanced Fabrications Poyle Ltd	01753 653617				●	●	●	●		●	●			●	●	✔	2			Up to £800,000
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*
Apex Steel Structures Ltd	01268 660828					●	●			●	●			●	●		2			Up to £3,000,000
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2			Up to £800,000
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
Austin-Divall Fabrications Ltd	01903 721950				●	●	●	●		●	●			●	●	✔	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			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			Up to £6,000,000
Builders Beams Ltd	01227 863770			●	●	●	●			●	●			●	●	✔	2	✔		Up to £2,000,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●				●	●	✔	4		Silver	Up to £4,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	Gold	Above £6,000,000
Cementation Fabrications	0300 105 0135	●			●		●	●			●		●		●	✔	3		Gold	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●		●	●	●			✔	4		Gold	Above £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
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £40,000
D Hughes Welding & Fabrication Ltd	01248 421104				●	●	●	●		●	●		●	●	●	✔	4			Up to £800,000
Duggan Steel	00 353 29 70072		●	●	●	●	●	●	●		●	●			●	✔	4			Up to £6,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	3			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 £3,000,000
Four Bay Structures Ltd	01603 758141			●	●	●	●	●		●	●			●	●		2			Up to £1,400,000
Four-Tees Engineers Ltd	01489 885899	●			●		●	●	●	●	●		●	●	●	✔	3		Member	Up to £2,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●		●	●				●		2			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)
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●		●		✔	3			Up to £3,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●		●	●			●	●	✔	2		● (green)	Up to £2,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £3,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✔	4		● (grey)	Up to £6,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●			●	●				●	✔	2			Up to £1,400,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●	✔	2			Up to £3,000,000
Intersteels Ltd	01322 337766	●			●	●	●	●		●				●	●	✔	3			Up to £2,000,000
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		● (orange)	Up to £6,000,000
Kloeckner Metals UK Westok	0113 205 5270												●			✔	4			Up to £6,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●					✔	2		● (grey)	Up to £6,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		3			Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✔	4		● (green)	Up to £2,000,000
M J Patch Structures Ltd	01275 333431				●					●	●				●	✔	3			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
Millar Callaghan Engineering Services Ltd	01294 217711									●				●	●	✔	4			Up to £1,400,000
Murphy International Ltd	00 353 45 431384	●			●		●	●	●		●				●	✔	4			Up to £1,400,000
Newbridge Engineering Ltd	01429 866722	●	●	●	●	●	●	●	●		●	●		●	●	✔	4		● (grey)	Up to £2,000,000
North Lincs Structures	01724 855512			●	●					●	●				●					Up to £400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●				●		✔	4		● (orange)	Up to £3,000,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●							●		2			Up to £400,000
Painter Brothers Ltd	01432 374400	●			●				●	●	●				●	✔	3			Up to £6,000,000*
Pencro Structural Engineering Ltd	028 9335 2886			●	●	●	●	●	●		●			●	●	✔	2			Up to £2,000,000
Peter Marshall (Steel Stairs) Ltd	0113 307 6730									●					●	✔	2			Up to £800,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		3			Up to £1,400,000
Robinson Structures Ltd	01332 574711			●	●	●	●				●			●	●	✔	3			Up to £6,000,000
S H Structures Ltd	01977 681931	●			●		●	●	●	●	●	●			●	✔	4	✔	● (orange)	Up to £2,000,000
SAH Engineering Ltd	01582 584220			●	●	●				●	●			●	●		2			Up to £800,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●				●			●	●	✔	4			Up to £2,000,000
Severfield plc	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	● (orange)	Above £6,000,000
SGC Steel Fabrication	01704 531286				●					●				●	●	✔	2			Up to £200,000
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 £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		2			Up to £1,400,000
Southern Fabrications (Sussex) Ltd	01243 649000				●	●				●	●			●	●	✔	2			Up to £1,400,000
Steel & Roofing Systems	00 353 56 444 1855			●	●	●	●				●	●		●	●	✔	4			Up to £3,000,000
Structural Fabrications Ltd	01332 747400	●							●	●						✔	3		● (grey)	Up to £1,400,000
Taunton Fabrications Ltd	01823 324266				●					●				●	●	✔	2		● (grey)	Up to £2,000,000
Taziker Industrial Ltd	01204 468080	●		●	●		●			●	●		●	●	●	✔	3			Above £6,000,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●			●	●			●	●	✔	2			Up to £400,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●			●	●	✔	3	✔	● (grey)	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 Haley Engineering Ltd	01278 760591				●	●	●									✔	4		● (orange)	Up to £4,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	● (orange)	Above £6,000,000
WT Fabrications (NE) Ltd	01642 691191			●	●	●	●				●			●	●	✔	4			Up to £40,000
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

RQSC – The Register of Qualified Steelwork Contractors Scheme

The Register of Qualified Steelwork Contractors Scheme for Bridgeworks (RQSC) is open to any Steelwork Contractor who has a fabrication facility within the 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
- **RF** Bridge refurbishment
- **AS** Ancillary 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, ● = Member)

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	RF	AS	QM	FPC	BIM	NHSS 19A	NHSS 20	SCM	Guide Contract Value [1]
AJ Engineering & Construction Services Ltd	01309 671919	●			●	●	●	●	●	●	●	✓	4				Silver	Up to £3,000,000
Bourne Group Ltd	01202 746666	●			●	●				●	●	✓	4	✓		✓	Gold	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	●	●	✓	4			✓		Up to £6,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●	●	●	●		●	●	✓	4			✓	Silver	Up to £4,000,000
Cementation Fabrications	0300 105 0135	●		●	●	●	●				●	✓	3			✓	Gold	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	Gold	Above £6,000,000
D Hughes Welding & Fabrication Ltd	01248 421104	●		●		●			●	●	●	✓	4			✓		Up to £800,000
Donyal Engineering Ltd	01207 270909	●		●						●	●	✓	3			✓	Silver	Up to £1,400,000
ECS Engineering Services Ltd	01773 860001	●			●	●	●		●		●	✓	3					Up to £3,000,000
Four-Tees Engineers Ltd	01489 885899	●			●	●	●		●	●		✓	3			✓	Member	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●				●				●	●	✓	4			✓	Gold	Up to £6,000,000
M Hasson & Sons Ltd	028 2957 1281	●	●	●	●	●	●	●	●	●	●	✓	4			✓	Member	Up to £2,000,000
Millar Callaghan Engineering Services Ltd	01294 217711	●						●		●	●	✓	4			✓		Up to £1,400,000
Murphy International Ltd	00 353 45 431384	●	●	●	●	●	●				●	✓	4			✓		Up to £1,400,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	Gold	Up to £4,000,000
S H Structures Ltd	01977 681931	●	●	●	●	●	●	●	●	●	●	✓	4	✓		✓	Gold	Up to £2,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	✓	4	✓	✓	✓	Gold	Above £6,000,000
Shaun Hodgson Engineering Ltd	01553 766499									●	●	✓	3			✓		Up to £800,000
Structural Fabrications Ltd	01332 747400	●		●	●	●	●			●	●	✓	3				Silver	Up to £1,400,000
Taziker Industrial Ltd	01204 468080	●		●	●	●	●	●	●	●	●	✓	3		✓	✓		Above £6,000,000
Underhill Engineering Ltd	01752 752483	●	●	●	●	●				●	●	✓	4	✓		✓		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			✓	Silver	Up to £4,000,000
Centregreat Engineering Ltd	029 2046 5683	●		●	●	●	●	●	●	●	●	✓	4					Up to £2,000,000
Cimolai SpA	01223 836299	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓		Above £6,000,000
CTS Bridges Ltd	01484 606416	●	●	●	●	●	●	●	●	●	●	✓	4			✓	Member	Up to £1,400,000
Ekspan Ltd	0114 261 1126	●				●			●	●	●	✓	2					Up to £400,000
Francis & Lewis International Ltd	01452 722200									●	●	✓	4			✓	Gold	Up to £2,000,000
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 £200,000
IHC Engineering (UK) Ltd	01773 861734	●									●	✓	3			✓		Up to £400,000
In-Spec Manufacturing Ltd	01642 210716									●	●	✓	4			✓		Up to £400,000
Lanarkshire Welding Company Ltd	01698 264271	●		●	●	●	●	●	●	●	●	✓	4		✓	✓	Gold	Up to £2,000,000
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
Control Energy Costs Ltd	01737 556631
Gene Mathers	0115 974 7831
Griffiths & Armour	0151 236 5656
Highways England Company Ltd	08457 504030
Inspire Insurance Services	02476 998924
Kier Construction Ltd	01767 640111
McGee Group (Holdings) Ltd	020 8998 1101
Sandberg LLP	020 7565 7000
Structural & Weld Testing Services Ltd	01795 420264
SUM Ltd	0113 242 7390

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.

1 Structural components
2 Computer software
3 Design services
4 Steel producers
5 Manufacturing equipment
6 Protective systems
7 Safety systems
8 Steel stockholders
9 Structural fasteners

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

SCM
Steel Construction Sustainability Charter
● = Gold,
● = Silver,
● = Member

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM	BIM
AJN Steelstock Ltd	01638 555500								●		M		
Albion Sections Ltd	0121 553 1877	●									M		
Arcelor Mittal Distribution - Scunthorpe	01724 810810								●		D/I		
Ayrshire Metals Ltd	01327 300990	●									M		✓
BAPP Group Ltd	01226 383824									●	M		
Barrett Steel Services Limited	01274 682281								●		M		
Behringer Ltd	01296 668259					●					N/A		
British Steel Ltd	01724 404040				●						M		
British Steel Distribution	01642 405040								●		D/I		
BW Industries Ltd	01262 400088	●									M		
Cellbeam Ltd	01937 840600	●									M		
Cleveland Steel & Tubes Ltd	01845 577789								●		M		
Composite Metal Flooring Ltd	01495 761080	●									M		
Composite Profiles UK Ltd	01202 659237	●									D/I		
Cooper & Turner Ltd	0114 256 0057									●	M		
Cutmaster Machines (UK) Ltd	01226 707865					●					N/A		
Daver Steels Ltd	0114 261 1999	●									M		
Daver Steels (Bar & Cable Systems) Ltd	01709 880550	●									M		
Dent Steel Services (Yorkshire) Ltd	01274 607070								●		M		
Duggan Profiles & Steel Service Centre Ltd	00353 567722485	●							●		M		
easi-edge Ltd	01777 870901							●			N/A	Gold	
Fabsec Ltd	01937 840641	●									N/A		
Farrat Isolevel	0161 924 1600	●									N/A		
Ficep (UK) Ltd	01924 223530					●					N/A		
FLI Structures	01452 722200	●									M	Gold	
Forward Protective Coatings Ltd	01623 748323						●				N/A		
Hadley Industries Plc	0121 555 1342	●									M	Silver	
Hempel UK Ltd	01633 874024						●				N/A		
Highland Metals Ltd	01343 548855						●				N/A		
Hi-Span Ltd	01953 603081	●									M	Member	

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM	BIM
International Paint Ltd	0191 469 6111						●				N/A	Gold	
Jack Tighe Ltd	01302 880360						●				N/A		
Jamestown Manufacturing Ltd	00 353 45 434288	●									M		
John Parker & Son Ltd	01227 783200								●	●	D/I		
Joseph Ash Galvanizing	01246 854650						●				N/A		
Jotun Paints (Europe) Ltd	01724 400000						●				N/A		
Kaltenbach Ltd	01234 213201					●					N/A		
Kingspan Structural Products	01944 712000	●									M	Gold	
Kloeckner Metals UK	0113 254 0711								●		D/I		
Lincoln Electric (UK) Ltd	0114 287 2401					●					N/A		
Lindapter International	01274 521444									●	M		
MSW UK Ltd	0115 946 2316	●									D/I		
Murray Plate Group Ltd	0161 866 0266								●		D/I		
National Tube Stockholders Ltd	01845 577440								●		D/I		
Peddinghaus Corporation UK Ltd	01952 200377					●					N/A		
PPG Architectural Coatings UK & Ireland	01924 354233						●				N/A		
Prodeck-Fixing Ltd	01278 780586	●									D/I		
Rainham Steel Co Ltd	01708 522311								●		D/I		
SDS/2 Ltd	07734 293573		●								N/A		
Sherwin-Williams Protective & Marine Coatings	01204 521771						●				N/A	Silver	
Structural Metal Decks Ltd	01202 718898	●									M		
StruMIS Ltd	01332 545800		●								N/A		
Stud-Deck Services Ltd	01335 390069	●									D/I		
Tata Steel – Tubes	01536 402121				●						M		
Tata Steel – ComFlor	01244 892199	●									M		
Tension Control Bolts Ltd	01978 661122						●			●	M		
Trimble Solutions (UK) Ltd	0113 887 9790		●								N/A		
voestalpine Metsec plc	0121 601 6000	●									M	Gold	
Wedge Group Galvanizing Ltd	01909 486384						●				N/A		
Wightman Stewart (WJ) Ltd	01422 823801					●					N/A