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# The surest way is steel

TATA STEEL

BCSA

# Contents





Introduction by Sarah McCann-Bartlett, Director General, British Constructional Steelwork Association

# The surest way is steel

Choice of framing material depends on many factors – design, cost, speed, safety, and sustainability are among the most critical. This supplement highlights steel's inherent advantages across all these areas and more, demonstrating that steel is flexible, cost efficient, quick and safe to build, and beats other materials hands down in the sustainability stakes when we take a whole of lifecycle approach.

So what are the facts?

- A recent independent cost comparison study showed that the frame for a three-storey business park office cost 10% less using steel rather than concrete
- The same study showed that a steel composite frame for an eight-storey city centre office block would be built 12 weeks faster than if it were made from concrete
- Reportable accidents in the steelwork sector have reduced by 60% since 2000
- Optimum thermal mass is mobilised from less than 100mm thickness of a concrete floor slab, meaning it is an option using standard steel construction without the excess weight and high carbon footprint of a full concrete frame
- The Target Zero study based on a real supermarket showed that the carbon footprint of the timber frame was 15% higher than the steel frame using a whole lifecycle assessment

The choice of steelwork contractor is also critical – with skill, commitment to quality, health and safety, sustainability and a proven track record of successful project delivery all important factors. British Constructional Steelwork Association (BCSA) members are regularly assessed against a number of key criteria and this information is available to search on the BCSA website or by an App available for download at the Apple App Store.

I'm sure you'll find this supplement interesting and informative. There are many critical factors to consider during the design and construction of buildings, but using steel is the surest way to satisfy them all.

# Steel - the go-to solution

## Sustainable and safe, lightweight yet durable, quality assured and cost-effective steel construction is the preferred approach to providing the buildings that the modern world depends on.

Profitable developments and value for money infrastructure depend on the cost-effectiveness and certainty of programme that steel construction has consistently proven that only it can deliver. Over the past 30 years steel has been the framing solution of choice for buildings of all sizes from single-storey logistics hubs and sheds of all types, to the largest multi-storey buildings, to the iconic structures that define our age.

Now, in a world focused on value for money and quality, developers and clients of all types increasingly appreciate the smaller upfront development costs, sustainability benefits and long-term cost advantages of operating and eventually decommissioning buildings and other structures made using steel.

Steel is enjoying increasing recognition as the go-to construction framing solution with a UK market share of over 90% of single-storey and 70% of multi-storey buildings. The UK's steel construction sector is the most successful and technically advanced in the industrialised world and members of the British Constructional Steelwork Association (BCSA) lead their field in investments in productivity and quality enhancing fabrication facilities.

Steel is an inherently safer method of construction, with a first-class record that is the envy of other sectors of the construction industry. Small teams of highly skilled erection professionals carry out the entire on-site process quickly and safely. Most of the work involved with steel frames and bridges is carried out offsite, in carefully controlled and monitored factory conditions, where exacting tolerances are routinely achieved regardless of the complexity of the structure.

Steel has more flexibility than any other material and buildings can be easily extended or reconfigured with minimal disruption to existing building users, and without expensive and often environmentally harmful demolition and redevelopment.

Steel construction allows architects the fullest expression of their vision, creating more of the iconic and landmark structures that grace our built environment than any other construction material. Whether the demand is for schools, shopping centres, commercial developments, stadiums or public buildings of all types, steel construction provides the modern looking, light and airy open spaces that people like to work, shop, study or relax in.

The buildings that people like last the longest. Steel-framed buildings retain their appeal for a lot longer than concrete and timber, which weather and date more quickly.

# Steel delivers on all fronts

Designing and building in steel is the surest way to guarantee the many value benefits such as safety, cost, aesthetics, efficiency and other gains that are demanded by clients for modern buildings, bridges and other structures. It is the best assurance that your project will be completed on time, cost-effectively, safely and to the most exacting quality and performance standards.



The market agrees, as is evidenced by steel construction's market share of 70% of multi-storey buildings, almost all single-storey industrial buildings, and an increasing share of other buildings sectors and bridges. Here are some of the wide range of benefits that are routinely delivered simply by choosing steel.

## SURETY OF SPEED

You won't fail to be impressed by the speed at which your steel building frame is safely erected, with much of the hard work to exacting tolerances already achieved offsite in factory controlled conditions – a truly modern method of construction. There are no labour intensive shuttering and propping activities to worry about, and no need for on-site storage for these bulky items. Early erection of a steel frame means follow-on trades achieve a weather protected environment in which to work sooner than is otherwise possible.

## SITE SAFETY SECURED

Steel construction is inherently safer than alternative forms of construction. Fabrication takes place offsite in the far safer environment of a factory; almost all of the potentially hazardous activity that is unavoidable with other methods of construction is managed out of the construction process by selecting steel.

Factory fabrication processes are standard and well practiced; providing a repeatable process that is predictable and inherently safe.

Highly trained, specialist erectors work from mobile elevating work platforms where they are securely harnessed. Trial erections can ensure that even the most complex operations, or where on-site time is at a premium, can be safely rehearsed to ensure that everyone understands their precise role when they reach site. Steel construction's proven safety record is the envy of the construction industry.

## LONG LASTING

A steel building is as flexible as its owner or user needs it to be. The light and airy column free spaces that can only be created with steel are capable of easy adaptation to multiple uses, and can be easily extended or reconfigured. Refurbishment and refreshing the appearance of a steel-framed building and changing its internal layout is relatively straightforward. However, steel buildings retain their modern appearance far longer than structures built with alternative materials. Consequently, refurbishment or alterations to exteriors are not usually needed.

Steel structures can be designed for dismantling; demountability will prove its worth on the legacy performance of the 2012 London Olympic and Paralympic Games where the main stadium and other venues have been designed to be reduced in size if required, and possibly relocated elsewhere in the country.

## STEEL AND SUSTAINABILITY

Steel has sustainability built-in - and has perhaps the strongest sustainability case of any rival material. It is the zero waste choice as steel is the world's most recycled material, none of it need ever go to landfill as it has a positive value and a key role to play in the production of new steel – some 94% of steel construction components in the UK are recycled or re-used.

Steel is multi-cycled, meaning it can be recycled repeatedly without any loss of its original properties – a characteristic not possessed by any other construction framing material. Steel structures generally have lower carbon footprints than concrete ones as a tonne of relatively stronger and lightweight steel goes further than a tonne of concrete. Steel sections can also be re-used on other structures as the working life of a steel section will typically far outlast the life of a modern building.

Steel offers environmental, social and economic advantages that feed through to an outstanding sustainability case – the Triple Bottom Line of economic, social and environmental benefits.

## WHOLE-LIFE IMPACTS

The cradle-to-gate approach to assessing environmental impacts is incomplete, and does not take into account the energy used during the building's operation and at the end of life. As the whole-life LCA begins to feature more and more on the sustainability agenda, it will not be 'good enough' to ignore these burdens. Clients are increasingly asking about whole-life impacts of the buildings they commission, which brings the recyclability and low embodied carbon benefits of steel into sharp focus.

## WORLD LEADING SPECIALIST STEELWORK CONTRACTORS

The BCSA steelwork contractor members are acknowledged world leaders. With partners steel producer Tata Steel and the Steel Construction Institute they have consistently invested in research and development and in new fabrication technology over the past 30 years.

There is a wide range of sizes and types of specialist contractors suitable for all projects of any scale from small sheds to the largest projects like Olympic venues, major commercial developments and airport terminals like Heathrow's Terminal 5. Advice on how to select the most suitable steelwork contractor for your project is freely available from the BCSA.

BCSA members work to the highest standards and are regularly assessed. They have prepared for the new Eurocodes and the steel sector has already produced design guidance for using Eurocodes.

BCSA members can undertake full turnkey design and build projects when required, and most now have in-house designers who can provide advice to clients as well as undertake design for key elements from connections to entire structural frames.

Steelwork has proved to be beneficial, on a number of fronts, for construction of a major development of canalside apartments in Walsall.

# Living with steel

"We looked at all materials including concrete and timber for this job, but after careful consideration we decided that steel met all of our needs, especially its speed of construction, as we had to meet a tight deadline," says Clive Jessup, Director of Jessup Build Develop, explaining the choice of framing material for the Waterfront South residential project.

Consisting of 265 canalside apartments in Walsall town centre, the project has already received considerable attention for its sustainability and design. Forming part of a much larger scheme, there are plans to transform this former industrial zone with further projects such as a hotel, retail outlets and office blocks.

The residential project has generated much local interest and helped turn this part of the town centre into a desirable location in which to reside. The project achieved some national recognition by winning the Best Canalside Regeneration Project in the UK 2011, awarded by the British Waterways Trust.

Funding for this two phase scheme came in part from the Government's Homes and Communities Agency, to provide a mix of affordable eco homes to rent or buy. The first phase, which was completed early in 2011, comprises two apartment blocks, one an eight-storey building with 84 flats, the other a five-storey structure with 17 apartments.

The second phase consists of a further 164 apartments, in two separate eight-storey blocks. The steelwork frames for this phase were completed during November 2011.

Each of the four residential blocks has reaped the benefits of being constructed with structural steelwork. Cost, efficiency and speed of construction were all important considerations when the choice of framing material was made.

"Steelwork met all our needs and was ideal for this project as we needed a lightweight framing solution because there are many old limestone mine workings beneath this part of Walsall," adds Mr Jessup.

Jessup Build Develop bought the site in 2005, and commenced building the apartments in January 2010. Prior to purchase most of the site had already been cleared of any old structures and the mineshafts grouted. Interestingly, one industrial unit has remained and stands in between phases one and two; this building is adjacent to a plot which has been earmarked for a commercial development consisting of 4,797m² of office space.

As previously mentioned, speed of construction was an important criteria, as the first phase had to be completed by March 2011. Steelwork contractor Traditional Structures' package also included supplying curved feature balconies, metal decking, precast stairs and the installation of insulated membrane roofs.

"The choice of metal decking with the steel frame creates a composite structure, which helped keep the weight down, compared to a precast solution," explains Graham Marshall, Partner of structural engineer B Marshall. "This then meant less cost, as smaller piled foundations needed to be installed."

As well as selecting to go with a steel-framed solution for the project, Jessup are also keen to point out that wherever possible they have also selected local subcontractors. Traditional Structures are one of these companies, being based just up the road at Cheslyn Hay.

Steelwork for all of the blocks has been erected around a fairly regular 6m and 8m wide grid pattern, with steel bracing providing the structure's stability.

"The majority of the bracing is located in partition walls and in corridors, but we've also fitted some in the exterior walls, but only where it wouldn't interfere with windows," explains Phil Hadley, Traditional Structures' Director.

Importantly, steel's flexibility came to the fore while the initial phase of apartments was already under construction. For architectural reasons, the eight-storey block's roof is not constant, but instead features a number of pitched steps. This originally meant some of the top floor apartments would have had a much higher floor to ceiling height than the block's other flats.



**WATERFRONT SOUTH, WALSALL**

Main client: Jessup Build Develop
Architect: S.P. Faizey
Main contractor: Jessup Build Develop
Structural engineer: B. Marshall
Steelwork contractor: Traditional Structures
Steel tonnage: 1,100t
Project value: £40M

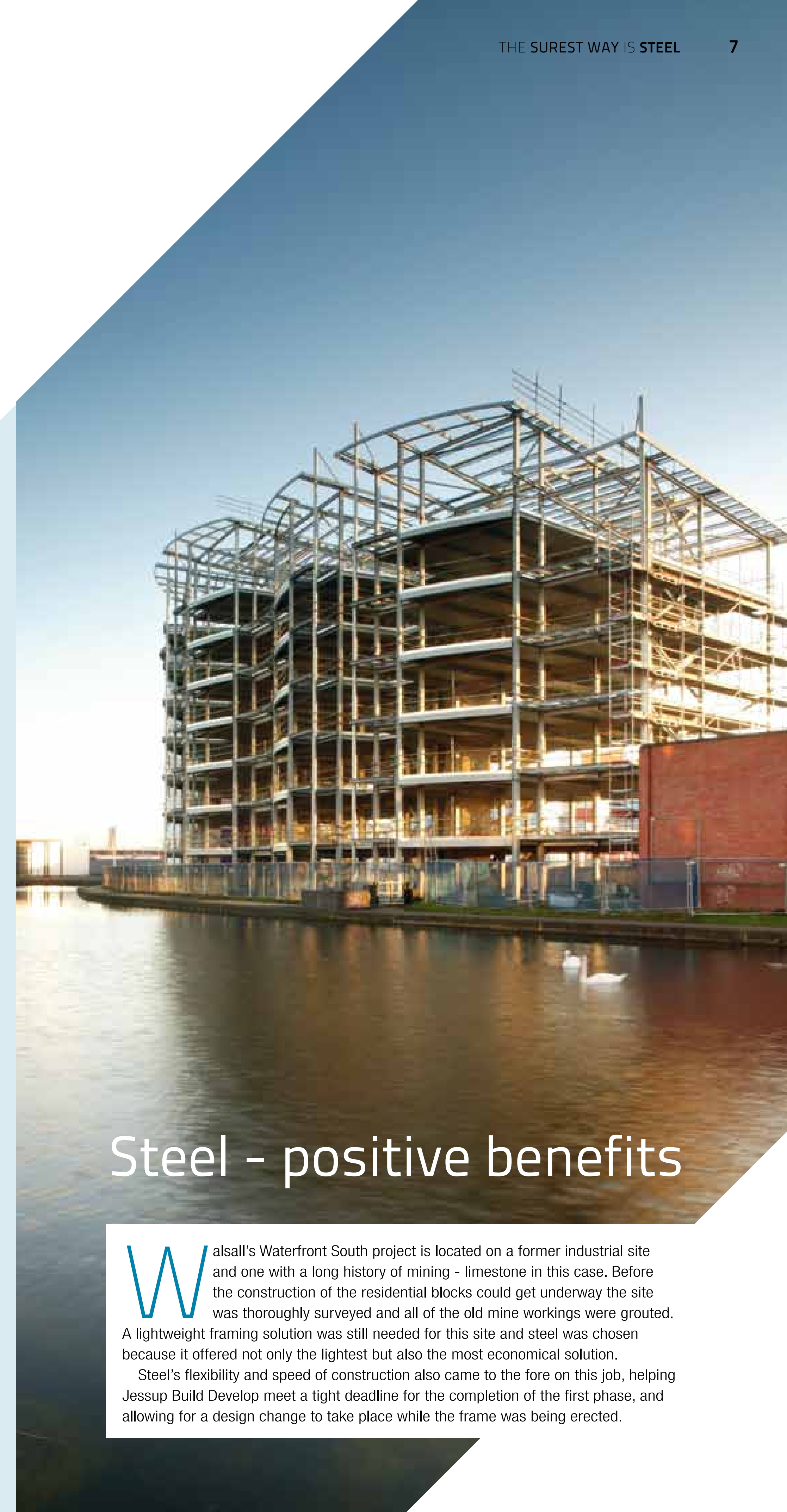
"Many of this building's apartments had already been leased to the Walsall Hospital Trust and they asked if they could have a few more three-bedroomed units than we had available," says Mr Jessup. "The architect, Steve Faizey, quickly realised that we could include an extra floor within three of the top floor units and convert them from two to three-bedroomed flats."

Steelwork erection was already underway, but this design alteration was easily and quickly incorporated into the steel package, and the entire project team say it could not have been achieved so effortlessly with any other framing material.

After analysing the structural model, the solution proved fairly simple and the supporting columns remained the same; only a few extra floor beams needed to be inserted into the framework to create what is in effect a mezzanine level.

Summing up the project, Mr Jessup says Jessup Build Develop has never built a residential scheme with steel before and the company pretty much learnt about the material as they went along.

Would they use steel again? Yes, he says. "We've used all other framing systems before and this one has worked well for us on this project, helping us to keep to a tight deadline and by being economical and flexible."



## Steel - positive benefits

Walsall's Waterfront South project is located on a former industrial site and one with a long history of mining - limestone in this case. Before the construction of the residential blocks could get underway the site was thoroughly surveyed and all of the old mine workings were grouted. A lightweight framing solution was still needed for this site and steel was chosen because it offered not only the lightest but also the most economical solution.

Steel's flexibility and speed of construction also came to the fore on this job, helping Jessup Build Develop meet a tight deadline for the completion of the first phase, and allowing for a design change to take place while the frame was being erected.


# A safety first culture

## Steel construction is one of industry's safest sectors due to safety improvements made by the BCSA and its membership.

Steel construction is statistically one of the safest construction sectors, helped in no small part by the British Constructional Steelwork Association's (BCSA) efforts in aiding its membership with guidance, documents and regular seminars.

The entire construction industry gains from steelwork's safety regime, as the sector's 'safety first' approach has resulted in some creditable and noteworthy performances. For instance, since 2000, reportable accidents in the sector have been reduced by 60%, while there has also been a significant reduction in the number of falls from height.

The sector has routinely taken the lead when it comes to safety initiatives and one of the best examples is the Safe Site Handover Certificate (SSHC). This is a BCSA initiative which ensures steelwork is erected safely by providing a checklist for key areas of safety that can be used as a basis of discussion between the principal contractor and the steelwork contractor.

In many ways the best, safest and most efficient way of erecting steelwork is for the entire project team to fully communicate and cooperate with each other. The SSHC provides this important and vital communication link, while also making sure a safe working environment, where poor site conditions - which could hinder the movement of that vital piece of steel erection equipment, the Mobile Elevating Work Platform (MEWP) - are either eliminated or avoided.

Although the use of MEWPs has brought significant improvements to the health and safety of the construction industry, good site conditions are necessary for plant equipment. A safe working environment is also a prerequisite for cranes, so they can perform safe lifting and placing of steel components.

Early planning and preparation are key parameters always undertaken by the BCSA's steelwork contractor members in order to maintain a safe environment.

Site conditions are always maintained to a high level throughout the steel erection programme and the SSHC provides the means for monitoring this. When a contract involves phasing, the SSHC can be used as a means of monitoring each individual phase.

All of the above criteria can be guaranteed by selecting a competent steelwork contractor, one which will ensure a safe environment for the erection plant and installation of the steelwork itself. By choosing a BCSA member, main contractors know they are employing the correct specialist subcontractor for the job. This is in no small part due to the fact that the BCSA regularly assesses its membership, continually verifying their competence and capabilities, thereby ensuring a safe steelwork construction sector.

# Working in isolation provides safe environment

One of the main health and safety requirements for any construction site is to provide a safe working environment for all of its workers. Areas of activity should be covered by a safety system or even an exclusion zone, which may be necessary where people are working overhead and the area below has to be kept clear.

This is always the case with steelwork erection as the job always has to incorporate a certain amount of working at height. Whether using cranes or MEWPs, the steelwork contractor will always cordon off the area where steel is being erected, thereby creating a safe environment.

An example of this safe practice was the work undertaken at the Rotherham Community Stadium, a new home for the town's football club. More than 1,100t of structural steelwork was erected to construct the stadium's four structurally independent stands.

"As each stand was erected the steelwork contractor (Elland Steel Structures) taped off the area to isolate it from the other on-site trades," says Gary Oates, Senior Project Manager for GMI Construction. "This guarded against any potential hazards while steelwork was being lifted into place."

As a matter of course, edge protection was erected along with the steelwork for each stand, creating a safe environment for follow-on trades such as metal decking installers and the concrete flooring contractor.

Elland Steel also installed the precast terrace units which sit on top of the stand's steel rakers. Consequently, the exclusion zone was maintained after steelwork had been completed to allow the precast units to be installed safely.

# Safe treatment for hospital project

More than 900t of structural steelwork was erected for an extension at the Royal Oldham Hospital. Steel was primarily chosen as the main framing material for its speed of construction, a major benefit on a job where the main contractor wanted the follow-on trades to start work on the project as quickly as possible.

As well as the speed with which steelwork was completed, the material provided other benefits for this project. Steelwork contractor James Killelea erected the steel in conjunction with an edge protection system. In this case it was the easi-edge system, and like all of these systems it is bolted to the steelwork on the ground and then lifted into place with the sections.

"Putting the easi-edge system in place with the steel was a real benefit as it stayed in place until the concrete floors were complete and the cladding was ready to commence," says John Fowler, Vinci Construction Project Manager. "Once the steelwork was erected we were left with a safe working environment for the other trades."

Vinci says the edge protection system was utilised until the cladding systems were ready to be installed. As the exterior of the building was clad the system was gradually dismantled and then returned to the steelwork contractor.

The Government set a deadline for all new buildings to be zero carbon by 2019. To achieve these lofty aims Target Zero, the first study of its kind, offers designers the necessary guidance.

# Aiming for zero

The British Constructional Steelwork Association (BCSA) and Tata Steel have together completed a £1M project to provide guidance on the design and construction of sustainable, low and zero carbon buildings in the UK.

Known as Target Zero, the project took two and a half years to complete and is the first ever study to make a detailed comparison of different energy efficiency measures and low or zero carbon technologies to identify the most cost-effective means of carbon reduction.

The guides on five different building types – schools, warehouses, supermarkets, offices and mixed-use buildings – provide the results of in-depth research to help construction professionals understand the most effective routes to achieve the Government's objective of zero carbon buildings.

By identifying the most cost-effective combinations of materials and technologies needed to construct low and zero carbon structures, Target Zero provides designers with the guidance they need to make informed decisions when designing cost-effective, sustainable buildings.

Alan Todd, BCSA Director Market Development, explains: "When these targets were initially set there was very little guidance available and engineers had to simply make assumptions as to which materials and technologies offered the best solution for particular projects".

The independent consultants which carried out the study were Aecom, helped by the Steel Construction Institute and Sweett Group. Design information from actual buildings was used for each of the five guides. These were then theoretically 'stripped back' to meet the minimum requirements for the 2006 Part L of the Building Regulations. These changes to the fabric and services of the actual buildings created the base case buildings which were used as benchmarks for the study. Energy efficiency measures and other sustainable improvements were then applied to the base case so that their effect could be measured and fully costed over a 25 year period.

Alan Todd said: "The work has been undertaken by leading organisations in the field of sustainable construction to provide information and guidance for construction clients and their professional advisors on how to design and construct sustainable structures. Our guides will enable designers to turn the aspirations of Government into reality."

The research for each building type considered operational carbon emissions, embodied carbon emissions and BREEAM. The guidance provides good insights on the cost-effectiveness of different operational energy efficiency measures; it provides the embodied energy of different construction forms using a whole-life 'cradle-to-grave' assessment; and advises how the three highest BREEAM ratings can be achieved.

The Target Zero guidance covers many complex solutions, but also highlights that some simple measures can be very effective. Many require little outlay in cash terms, but just require some forethought during the design stage. Examples are the building's orientation, optimisation of natural light by correctly positioning windows and use of efficient lighting.

Prior to the publication of the Target Zero reports, there was very little information available. Each Target Zero report contains around 80 pages and they are available for download from *www.targetzero.info*. The reports provide useful information that will help designers meet the emissions target reductions set by Government.

The industry experts who worked on the Target Zero guidance reports are available to deliver in-house training on the key messages of low and zero carbon construction. Details can be found on the Target Zero website.

**It was decided at an early stage that Target Zero should use real building designs as the basis of the research. Five client organisations were approached and they generously supported the project. The five buildings were already sustainability exemplars, so it was necessary to 'dumb down' the design information before the improvement measures could be added and then assessed.**

For the office research, One Kingdom Street, near Paddington railway station in central London, which Development Securities completed in 2009, formed the base case. Providing 24,490$m^2$ of open plan office space over 10 floors, the structure was designed to achieve the maximum floor plate depth in line with British Council of Offices guidance.

The schools report is based on Christ the King Centre for Learning in Knowsley, Merseyside. Built as part of the Building Schools for the Future programme and opened in 2009, the project's main contractor was Balfour Beatty. This is a 9,637$m^2$ steel-framed building, based on a 9m × 9m structural grid.

The warehouse study is based on the 34,000$m^2$ DC3 distribution centre at Prologis Park, Stoke. The structure is a four span steel portal framed warehouse, attached to a two-storey office block.


The base case building for the supermarket study is based on Asda's food store at Stockton-on-Tees, completed in May 2008. The retail floor area, totals 5,731$m^2$, which includes a mezzanine level of 1,910$m^2$

The mixed-use report is based on the Holiday Inn tower block on the MediaCityUK development, part of a much larger scheme which houses the BBC. The tower block used for the study is attached to the main studio building and comprises office space in its lower half and hotel above.

## Thermal mass with steel

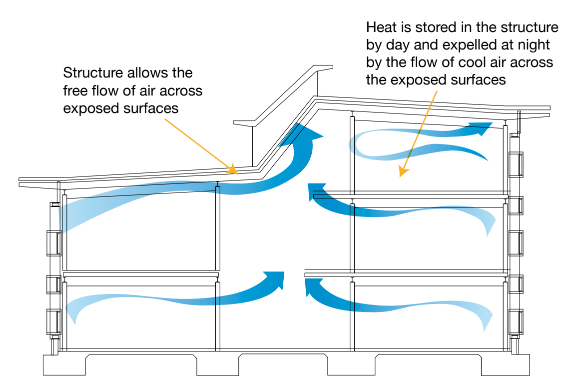
Many designers are looking to mobilise the thermal mass of a building to help minimise the energy required for cooling. It is believed in some quarters that large, heavy buildings are capable of mobilising greater amounts of thermal mass than lightweight alternatives. This has led to a situation where many designers wishing to utilise thermal mass turn to reinforced concrete frames. However, independent research has shown that optimum thermal mass is provided by the first 100mm of concrete in a floor slab. This is available using standard steel-framed construction, so there is no advantage in using heavyweight buildings for thermal mass. The additional weight has no useful purpose, but does increase the building's carbon footprint.

To confirm this, the issue of maximum effective floor thickness was addressed in three of the buildings analysed in Target Zero: the school; the office: and the mixed-use building.

Assessment of the school's carbon emissions showed that the cooling requirement was small and so there was little point in trying to utilise thermal mass. However, the study was expanded to address what might have been the case had the cooling requirements been higher. This showed that the amount of excess energy soaked up by the floors would have been the same regardless of the framing system but that the high level of compartmentation in the building would have prevented the free flow of night-time cooling air required to make the thermal mass work.

For both the office and the mixed-use building, the thermal mass in the buildings was provided equally by steel and concrete framing solutions. It was interesting to note that, in both cases, detailed thermal analysis showed that the benefit of thermal mass was negated by the need to heat and cool an extra volume of air created by the removal of the ceiling tiles to expose the concrete soffit.

In addition to the Target Zero research, there are numerous real world examples where thermal mass has been successfully utilised using a steel frame.



# Target Zero's vital statistics

## The key findings of the five Target Zero guides, at a glance.

### Schools

The building on which the schools research was based, is the Christ the King Centre for Learning secondary school in Knowsley, Merseyside. This BSF building was completed in December 2008 and is occupied by 900 pupils and 50 staff. The gross internal floor area of the school is 9,637$m^2$.

#### Key findings for Schools

- The 2010 Part L compliance target of reducing regulated operational carbon emissions by 25% is achievable by using only energy efficiency measures at an increased capital cost of just 0.14%
- Operational carbon emission reductions over 100% of regulated emissions can be achieved most cost-effectively using a package of energy efficiency measures plus a wind turbine, photovoltaics, a biomass boiler and solar thermal panels. These measures incur an increased capital cost of 12%
- Relative to the structural steel frame supporting pre-cast concrete floor slabs base case[1], an in-situ reinforced concrete structure building has a higher (11%) carbon footprint (embodied carbon impact) and a steel composite structure has a marginally (3%) lower impact
- The estimated capital cost uplift of the base case school building to achieve BREEAM ratings was:
  0.2% to achieve BREEAM 'Very Good'
  0.7% to achieve BREEAM 'Excellent'
  5.8% to achieve BREEAM 'Outstanding'

### Warehouses

The warehouse study was based on the DC3 distribution centre on Prologis Park, Stoke-on-Trent. It was completed in December 2007 and is currently leased to a large UK retailer. The net internal floor area of the warehouse is 34,000$m^2$. Attached to the warehouse is a two-storey office wing providing 1,400$m^2$ of floor space. It is a four span, steel portal frame, with each span measuring 35m with a duo pitch, lightweight roof supported on cold rolled steel purlins.

#### Key findings for Warehouses

- Lighting was found to be the most significant energy demand in the warehouse building studied, accounting for around three quarters of the total operational carbon emissions. Consequently efficient lighting systems coupled with optimum roof light design were found to be key in delivering operational carbon reductions
- The 2010 Part L compliance target of reducing regulated carbon emissions by 25% is achievable by using a more efficient lighting system alone. This is predicted to yield a 37% reduction in regulated carbon emissions
- A package of compatible, cost-effective energy efficiency measures were predicted to yield a 54% reduction in regulated emissions relative to the base case[1] warehouse, with a reduced capital cost of 0.98%
- The estimated capital cost uplift of the base case warehouse to achieve BREEAM ratings was:
  0.04% to achieve BREEAM 'Very Good'
  0.4% to achieve BREEAM 'Excellent'
  4.8% to achieve BREEAM 'Outstanding'

[1] The base case buildings were defined based on actual buildings, i.e. based on the same dimensions, specification, etc. Changes were then made to the fabric and services of the actual building to provide a base case building that is representative of current practice and just complies with the requirements of Part L (2006).



### Supermarkets

The building on which the supermarket research was based, is the Asda food store in Stockton-on-Tees, Cleveland. This supermarket has a total floor area of 9,393$m^2$ arranged over two levels. The roof is a monopitch, aluminium standing seam system and the external walls are clad with steel-faced composite panels.

#### Key findings for Supermarkets

- Lighting was the most significant energy demand in the supermarket building, accounting for around a half of the total operational carbon emissions
- The 2010 Part L compliance target of reducing operational carbon emissions by 25% is achievable by using a package of compatible, cost-effective energy efficiency measures which are predicted to yield a 35% reduction in regulated carbon emissions relative to the base case[1] supermarket, achievable at a capital cost reduction of 0.36% using high efficiency lighting alone.
- A zero carbon supermarket is achievable by using energy efficiency measures and on-site low and zero carbon technologies. However they incur a minimum capital cost increase of 26.5%. They include a large 330kW wind turbine and biogas-fired CCHP
- The estimated capital cost uplift of the base case supermarket to achieve BREEAM ratings was:
  0.24% to achieve BREEAM 'Very Good'
  1.76% to achieve BREEAM 'Excellent'
  10.1% to achieve BREEAM 'Outstanding'

### Offices

The office research is based on One Kingdom Street, located in the Waterside regeneration area near Paddington station in London. This Grade A office building accommodates 24,490 $m^2$ of open-plan space on ten floors and, on the eastern half of the building, two basement levels provide car parking and storage. The building has a steel frame, on a typical 12m x 10.5m grid, comprising fabricated cellular steel beams supporting a lightweight concrete slab on a profiled steel deck.

#### Key findings for Offices

- Significant reductions in operational carbon can be achieved relatively easily and cheaply using energy efficiency measures and low and zero carbon technologies. For example, the 2010 target of 25% reduction in regulated carbon emissions can be achieved using energy efficiency alone at a capital cost increase of only 0.28% and a 44% reduction can be achieved by the addition of low and zero carbon technologies at a capital cost increase of 1.6%. However, one hits the law of diminishing returns quickly and large reductions in carbon emissions will be heavily dependent on the availability of Allowable Solutions.
- Relative to the base case building, an equivalent post-tensioned concrete structure office building had an 11.9% higher embodied carbon impact and was 72% heavier
- The estimated capital cost uplift of the base case office to achieve BREEAM ratings was:
  0.17% to achieve BREEAM 'Very Good'
  0.77% to achieve BREEAM 'Excellent'
  9.83% to achieve BREEAM 'Outstanding'

### Mixed-Use

The mixed-use research is based on the Holiday Inn tower located in MediaCityUK. Part of a much larger scheme, MediaCityUK includes 65,032$m^2$ of office space across five buildings, a 23,225$m^2$ studio block, 7,432$m^2$ of retail space and two residential apartment tower blocks. The Holiday Inn is attached to the main studio building at ground mezzanine and first floor levels, made up of office space in its lower half and the hotel above with the hotel reception and restaurant on the ground and mezzanine levels.

#### Key findings for Mixed-Use

- The 2010 Part L compliance target of reducing regulated operational carbon emissions by 25% is achievable by using a package of compatible, cost-effective energy efficiency measures, without the need for LZC technologies.
- The greatest on-site carbon reduction of 138% of regulated emissions is achieved by a package of advanced energy efficiency measures such as photovoltaic panels, a wind turbine and biogas-fuelled CCHP supplying heating, hot water, power and cooling.
- The estimated capital cost uplift of the base case[1] mixed-use scheme to achieve BREEAM ratings was:
  0.14% to achieve BREEAM 'Very Good'
  1.58% to achieve BREEAM 'Excellent'
  4.96% to achieve BREEAM 'Outstanding'

# Cradle-to-grave

Assessing the environmental performance of building materials plays a crucial role not just for clients but for the sector as a whole. The BCSA and Tata Steel are committed to helping the construction industry obtain a true and accurate picture of environmental performance. Cradle-to-grave assessment is the next step.

In recent years global warming and the greenhouse gas emissions which cause it has risen to the top of the sustainability agenda. A large part of the problem is the carbon dioxide emitted during power generation by conventional power stations. This has resulted in a keen focus on the energy efficiency of buildings, so that 'carbon' generated during a building operation can be reduced as much as practicable. It is now generally accepted that any credible new building or refurbishment must use the minimum of energy during its operational life.

Attention is now widening to the parts that make up the building. All the products and materials used to create a building add to the carbon footprint. The greenhouse gases emitted during production, transport and disposal of a building's parts should also be minimised for a project to be truly sustainable.

The challenge to do this sensibly is that designers and clients need to know how much environmental impact is 'embodied' within each product. This requires a Lifecycle Assessment (LCA) to be carried out.

LCA is in its relative infancy for construction materials. There is very little data available, much of it poor and incomplete which makes it very difficult to properly compare one material with another. The steel industry is committed to making assessments in an accurate way, but a major change is required, otherwise the current easier to carry out approach will be accepted as 'good enough'.

The existence of readily available information has seen a tendency to carry out the simplified cradle-to-gate assessment – this is from origination until the product leaves the factory gate. This approach, while much easier to undertake, ignores many significant environmental burdens from later stages of a product lifecycle. For example, a cradle-to-gate analysis makes no differentiation at all between a product which wears out quickly, needs frequent replacement and has no useful further purpose so finds its way to landfill, with one that is durable, recycles easily through numerous further uses and never becomes waste.

These end-of-life scenarios are incorporated in a whole lifecycle analysis referred to as cradle-to-grave. Steel benefits hugely from a cradle-to-grave analysis as it can be re-used or recycled endlessly without loss of property or performance. Other materials, such as timber, do not compare as favourably. Timber sent to landfill will decay to form methane, which is 20 times more virulent as a greenhouse gas than carbon dioxide. Recent TRADA figures indicate that up to 80% of timber waste in the UK goes to landfill. This enormous environmental burden is completely ignored using a cradle-to-gate analysis.

There is no doubt that, given the option, anyone serious about sustainability would choose a whole lifecycle cradle-to-grave assessment. The alternative is misleading and may ignore the major burdens. If environmental problems are ignored there is no necessity to correct them.

Best practice is to use the best whole lifecycle data available, which is based on current end-of-life outcomes. These may change over time, but that will only happen if the problem receives attention. Figures for some of the major construction frame materials are listed in the table opposite.

## Embodied carbon comparison

While cost and programme are key criteria in assessing design options for many projects, the comparative environmental credentials are also important. Peter Brett Associates (PBA) has carried out an embodied carbon assessment for a typical building using steel or concrete framing options.

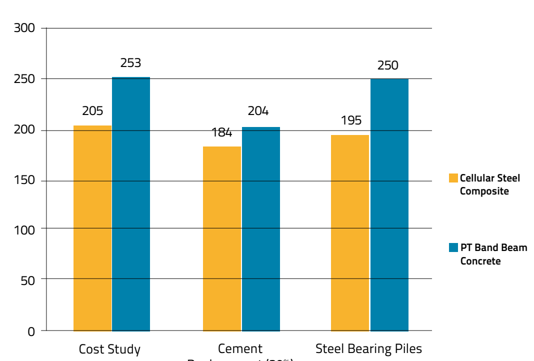
The study considered the whole building rather than just the structural frame for each option; however it focused on the emissions from the structural elements as they represent the main carbon differences between the options.The results of the study are shown in the diagram.

PBA firstly assessed the buildings using Portland Cement for the concrete mix, which demonstrated that the embodied carbon was significantly lower for the steel frame than that for the concrete frame; with the steel option having an embodied carbon over 23% less than the concrete option. The substitution of OPC with cement replacement reduced emissions for both options, with an 11% emissions saving made by the steel frame.

The impact of using steel bearing piles on the embodied carbon for both frame options was also assessed based on alternative substructure solutions developed by PBA and Tata Steel which utilised 356 × 368 × 152 UKBP in lieu of CFA piles.

The use of steel bearing piles results in an increased number and length of piles for both frame options, from 147nr (2,490m) to 190nr (3,984m) for the steel frame and from 150nr (3,225m) to 241nr (5,400m) for the concrete option; however, there are offsets in terms of a significant reduction in the size of pile caps and associated reductions to excavation and disposal for both options.

"Steel bearing piles can also be extracted at end of life and recycled or re-used elsewhere," says Fergal Kelly, PBA Director.




**Building 2* Cradle to Grave embodied carbon comparison**
**Vertical axis of diagram includes units $kgCO_2/m^2$**
*** for Building 2 description see p19**



# Cradle-to-grave embodied carbon of materials

Below is a table showing the full lifecycle (cradle-to-grave) embodied carbon of some common construction materials. These values were generated for the Target Zero low carbon building study using recognised information sources. They are presented as an appendix within the Target Zero guidance documents. See *www.targetzero.info*

| MATERIAL | DATA SOURCE | END OF LIFE ASSUMPTION | SOURCE | TOTAL LIFECYCLE $CO_2$ EMISSIONS ($tCO_2e/t$) |
|---|---|---|---|---|
| Fabricated steel sections | Worldsteel (2002) | 99% closed loop recycling 1% landfill | MFA of the UK steel construction sector[1] | 1.009 |
| Steel purlins | Worldsteel (2002) | 99% closed loop recycling 1% landfill | MFA of the UK steel construction sector[1] | 1.317 |
| Organic coated steel | Worldsteel (2002) | 94% closed loop recycling 6% landfill | MFA of the UK steel construction sector[1] | 1.613 |
| Steel reinforcement | Worldsteel (2002) | 92% recycling, 8% landfill | MFA of the UK steel construction sector[1] | 0.820 |
| Concrete (C25) | GaBi LCI database 2006-PE International | 77% open loop recycling 23% landfill | Department for Communities and Local Government[2] | 0.132 |
| Concrete (C30/37) | GaBi LCI database 2006-PE International | 77% open loop recycling 23% landfill | Department for Communities and Local Government[2] | 0.139 |
| Concrete (C40) | GaBi LCI database 2006-PE International | 77% open loop recycling 23% landfill | Department for Communities and Local Government[2] | 0.153 |
| Glulam | GaBi LCI database 2006-PE International | 16% recycling, 4% incineration, 80% landfill | TRADA[3] | 1.1 |
| Plywood[5] | GaBi LCI database 2006-PE International | 16% recycling, 4% incineration, 80% landfill | TRADA[3] | 1.05 |
| Plasterboard | GaBi LCI database 2006-PE International | 20% recycling, 80% landfill | WRAP[4] | 0.145 |
| Aggregate | GaBi LCI database 2006-PE International | 50% recycling, 50% landfill | Department for Communities and Local Government[2(a)] | 0.005 |
| Tarmac | GaBi LCI database 2006-PE International | 70% recycling, 23% landfill | Department for Communities and Local Government[2] | 0.020 |

1 Material flow analysis of the UK steel construction sector. J. Ley 2001.
2 Survey of Arisings and Use of Alternatives to Primary Aggregates in England, 2005 Construction, Demolition and Excavation Waste, *www.communities.gov.uk/publications/planningandbuilding/surveyconstruction2005*
(a) Adjusted for material left in ground at end of life.
3 TRADA Technology wood information sheet 2/3 Sheet 59 'Recovering and minimising wood waste', revised June 2008.
4 WRAP Net Waste Tool Reference Guide v1.0 2008 (good practice rates)
5 Data excludes $CO_2$ uptake or $CO_2$ emissions from biomass

# Carbon footprint of buildings

The above table of values can be applied to the weight of materials used in a building to provide the overall carbon footprint. The table shows that the embodied carbon of steel and timber are similar when assessed on a cradle-to-grave basis, due to the high recycling rate for steel and the less satisfactory end-of-life options for timber. The embodied carbon of concrete is less than steel when measured on a per tonne basis. However, one tonne of structural steel goes a lot further than one tonne of concrete, so steel-framed buildings have a lower carbon footprint as shown in the adjacent table. In reality, buildings are made up of a mix of different materials.

The independent Target Zero study of sustainable low and zero carbon buildings compared the embodied carbon of whole buildings using different primary framing materials. The results are summarised here on a per metre basis.

| BUILDING TYPE | EMBODIED CARBON PER SQUARE METRE ($kgCO_2e/m^2$) | | | | | |
|---|---|---|---|---|---|---|
| | STEEL OPTION | | CONCRETE OPTION | | TIMBER OPTION | |
| | WHOLE BUILDING | STRUCTURE ONLY | WHOLE BUILDING | STRUCTURE ONLY | WHOLE BUILDING | STRUCTURE ONLY |
| School | 301 | 118 | 344 | 156 | - | - |
| Multi-storey office | 452 | 219 | 506 | 266 | - | - |
| Multi-storey mixed-use | 395 | 218 | 467 | 259 | - | - |
| Warehouse | 234 | 32 | - | - | 266 | 59 |
| Out of town supermarket | 376 | 58 | - | - | 384 | 66 |

The detailed reports for each of the five buildings are available at *www.targetzero.info*

# Landmark offices rise in Birmingham

Speedy steel-framed construction has allowed a 17-storey Birmingham office block, complete with a glazed atrium roof and bow-string trusses to be built in just 30 weeks.

A shortfall in high-spec offices in Birmingham is making Number Two Snowhill a highly anticipated property. The 17-storey office block with four additional basement levels for car parking, scenic lifts and a stunning steel-framed glazed atrium is the second of three landmark office blocks in the Snowhill area of Birmingham and will be 65m tall.

While this premium office space is eagerly awaited in the city, construction came to a standstill two years ago, but restarted in May 2011 with developer Hines at the helm and design and build contractor Balfour Beatty keen to pick up the pace of construction.

Inheriting a structure added certain risks, admits Balfour Beatty Project Director David Tighe, but careful surveying, checking and rechecking has meant that the new structure has flown up - and to tight geometrical tolerances.

"Every steel connection to the core is bespoke, requiring us to measure the exact geometry and then fabricating elements to exact dimensions," says Mr Tighe.

The contract was let on a design and build basis to steelwork contractor Caunton Engineering. The company has designed, fabricated and supplied over 2,000t of structural steelwork together with metal decking and shear studs for the project.

The building footprint covers an area 54m long by 45m wide and is made up of a 9m × 9m structural grid. The main entrance façade tapers out from ground level up to level 13 where the building then steps back, creating balconies.

Double height spaces at level 15 and 16 contain plant. Above ground level, floors are of composite construction with steel beams and columns framing into the three main stability elements – the reinforced concrete cores.

A steel-framed solution was an obvious choice for the building explains Curtins Consulting Project Engineer Yvonne Aust, since it could connect back to the existing cores easily and construction could proceed quickly. With offices occupying the majority of the floors, clear spans and a flexible structure were also very important for the client.

"Cellular steel beams offered the most practical solution by being able to achieve long spans efficiently without being too heavy," says Ms Aust. Services could also be threaded through the openings in the beams and concealed within the ceiling void. Metal decking and a 150mm thick concrete slab make up the floor depth. Floor beams have been pre-cambered in readiness for cladding loads and other finishes.

An atrium occupies the centre of the building from ground floor. The curved roof for this structure is supported by a system of steel "trees" which spring from level 14 and 15. The tallest double-storey tree sits at level 14 and is made from a 406mm diameter circular hollow section "trunk" with four "branches" supporting steel beams in the atrium roof. The remaining "trees" sit at level 15 and support the perimeter of the roof. These elements are all circular hollow sections, apart from twin box section columns which support the lower edge of the roof and sit at level 14.

"Caunton erected the atrium roof in the factory first to make sure everything would fit perfectly because there was no room for error on-site," says Mr Tighe. He adds that there is sometimes just a few days between a survey being carried out, steel elements being approved and then fabricated. The atrium steelwork has been erected using tower cranes at night time, when there is less demand for cranes by other trades. Some floorplates around the atrium have been left out to allow some of the longer roof elements to be slewed up through the building.

Bow-string trusses which support glazing for the scenic lift offer some of the most technical challenges for the design and build team on this project. The trusses were originally designed to work in tension, but the main contractor felt that this would take too long to build and impact on the construction programme. "Building the bowstring trusses in tension meant that we'd have to weigh them down from the top so the trusses could only be erected after the [entire] main structure had been built," recalls Mr Tighe.

## Trusses support glazing

To allow the trusses to be erected as the building went up required Curtins and Caunton to redesign it so that some tension elements resisted compression. Caunton steelwork designer Matt Shimwell explains how the bow-string trusses work: "To maintain a very slender design, combinations of triangulated compression and tension members were used. These members took the form of tapered Macalloy compression struts and tension rods. The glazing is supported laterally at each storey level by means of both feature bow-string trusses and cantilevered arms braced off the shear walls. To enable the structure to be erected from the ground up, tapering vertical trusses act as columns which support approximately 35t of glazing. The glazed panels also transmit an eccentric load to the bow-string trusses, which is resolved into tension forces resisted by inner vertical tie rods."



**SNOWHILL BUILDING TWO, BIRMINGHAM**

Main client: Weedon Partnership
Main contractor: Balfour Beatty Construction
Structural engineer: Curtins Consulting
Steelwork contractor: Caunton Engineering
Steel tonnage: 2,000t

# Sustainable steel is cost-effective

Higher sustainability due to advantages like lower levels of embodied carbon is being routinely achieved on steel-framed buildings when compared to concrete alternatives, along with the traditional cost and other advantages of steel construction.

A new report based on research by quantity surveyor Gardiner & Theobald, consultant Peter Brett Associates (PBA) and contractor Mace shows the cost and lower embodied carbon benefits of steel being delivered on two typical modern office blocks – a three-storey business park office, Building 1; and an eight-storey city centre office, Building 2

The frames were designed by PBA, with cost information for each option from G&T with Mace considering buildability, logistics and programme. PBA also carried out an embodied carbon assessment for Building 2.

The research discovered that the total building cost for the steel options are on average 5% lower than the concrete options because of lower floor and frame costs, smaller foundations, lightweight roofs, lower storey heights, reduced cladding costs and reduced preliminaries costs.

The steel-framed options were up to nine per cent lower cost than for concrete when the frame and upper floors alone were considered. Construction programmes for steel-framed solutions were 13% shorter compared with the concrete-framed option for the three-storey office, and 11% shorter for the eight-storey city centre office.

The city centre office cellular steel option also had an 18-30% lower embodied carbon total than the post tensioned band beam option.

'To benchmark steel against alternative materials on cost and sustainability, we commission construction experts to design real buildings as they would for any client,' says Tata Steel Construction General Manager Alan Todd. 'We look at the frame individually and also the whole building as a steel frame generates a cost and carbon saving for other elements, such as foundations and cladding.'

Assessing the embodied carbon of the steel and concrete alternatives for the eight-storey city centre block took account of the fact that almost all steel used in a building will be recycled or re-used at the end of a building's life, rather than sent to lower grade uses like granular fill after being crushed, as concrete would be.

Best practice for sustainability currently is to consider replacement of Ordinary Portland Cement with fly ash and ground granulated blast furnace slag in concrete, so this was also considered in the embodied carbon assessment for Building 2. Other sustainability benefits from using steel that came into the picture included the impact of using steel piles rather than concrete, as easily removable steel piles leave no 'legacy effect' whereas sometimes near impossible to remove concrete piles can hinder some future developments.

Mr Todd said:'Driven steel piles are the sustainable option for foundations because they require smaller pile caps, no excavation or disposal of spoil and can be extracted for recycle or re-use when the building is decommissioned.'

## Embodied carbon assessment for a city centre office

A cradle-to-grave assessment for carbon dioxide emissions was made for the city centre office block. This considered the embodied carbon of producing the framing material and frame elements, constructing the building and what happens to the material when the building is decommissioned. It excluded carbon emissions related to running the building.

Industry data on materials' emissions was supplied from Target Zero publications for steel and from Concrete Centre publications for concrete.

PBA initially assessed the buildings in line with the cost study and used Ordinary Portland Cement (OPC) for the concrete mix, which demonstrated that embodied carbon was significantly lower for the steel frame than for the concrete frame. The steel option had an embodied carbon over 23% less than the concrete option.

The assessment was recalculated for best practice where 30% of the primary sourced OPC was replaced with more sustainable fly ash and ground granulated blast furnace slag. This reduced the embodied carbon of both framing options, but the steel composite option still had around 11% less embodied carbon than the post tensioned concrete one.

Adopting driven steel piles for each option was also considered as a more-sustainable alternative to concrete continuous flight auger piled foundations. This resulted in longer piles for both options, which increased foundation costs. However, these were offset partly by a faster substructure construction programme.

Across the whole building, the embodied carbon reduced to 195kg$CO_2$/m² for the steel option and to 250kg$CO_2$/m² for the post-tensioned concrete option.

**More detail on the study can be found at *www.steelconstruction.org/comparison***

## Building 1 – a three-storey business park office

This is an out-of-town rectangular building with a gross internal area of 3,200m² with an 18m deep floor plate and structural grid of 7.5m × 9m with a central core. Its external envelope of brick outer-skin has an allowance for windows at 35% of the façade area.

Four viable framing solutions were developed by PBA:

- Steel composite beams and composite slab
- Steel frame and precast concrete slab
- Reinforced concrete flat slab
- In-situ concrete frame with post tensioned slab

The two steel design solutions were found to be cheaper to build than either of the concrete options because of a shorter construction period for the steel frame and its foundations. A steel frame is inherently lighter than a concrete frame, so the foundations were quicker and cheaper to build. The steel composite beam and slab frame solution had the lowest frame and floor as well as overall building cost.

**Costs for Building 1**

Expressed in £/m² gross internal floor area

| | Steel composite | Steel + precast concrete slabs | Reinforced concrete flat slab | Post-tensioned concrete flat slab |
|---|---|---|---|---|
| Substructure | £52 | £55 | £67 | £62 |
| Frame and upper floors | £140 | £151 | £155 | £150 |
| Total building | £1,535 | £1,561 | £1,631 | £1,610 |

The programme for both steel options was 45 to 47 weeks, with the steel composite solution being the quickest. Both concrete options took over 48 weeks.

The frame and floor cost for the steel-framed options are up to 10% lower than for the concrete option and the overall building cost is up to six per cent lower than for concrete. Both steel-framed options can be built on average over five per cent faster than the concrete options.

## Building 2 – an eight-storey city centre office

This L-shaped building has a gross internal area of 16,500m² with a 7.5m × 15m structural grid and double height reception area and central core. The external envelope is a unitised curtain wall system. Two viable framing solutions were developed by PBA:

- cellular composite beams and composite slab (steel composite option);
- post tensioned band beams and slab with insitu columns (post-tensioned concrete option).

The steel composite option had both a lower frame and floor cost and lower total building cost than the post tensioned concrete band beam option. The steel composite option also had a lower floor to floor height (4.18m compared to 4.375m) which resulted in a 5% smaller external envelope and reduced cladding cost.

G&T's programme study revealed that the steel composite option provided a 12-week faster construction programme for the frame and an eight-week faster programme for the overall build compared with the post tensioned concrete option.

The frame and floor cost of the steel composite option is over eight per cent lower and the overall building cost is up to three per cent lower than the post-tensioned concrete option.

**Costs for Building 2**

Expressed in £/m² gross internal floor area

| | Steel cellular composite | Post-tensioned concrete band beam and slab |
|---|---|---|
| Substructure | £56 | £60 |
| Frame and upper floors | £194 | £210 |
| Total building | £1,861 | £1,922 |

# Selecting with confidence

Choosing which of the BCSA's regularly assessed steelwork contractors is most appropriate for your project has been made straightforward by a special section on the BCSA's website and by a new App.

A major strength of the steelwork sector is that there is a wide choice of highly skilled steelwork contractors with a real commitment to quality, health and safety, sustainability and a proven track record of successful project delivery. This level of competition ensures that steelwork remains the economic choice for building frames, bridges and other structures.

Choice is clearly a good thing, but how do you decide which steelwork contractor is best for your job? Fortunately the process is simplified as all members of the British Constructional Steelwork Association (BCSA) are regularly assessed against a number of key criteria. This information is openly available to search on the BCSA website *www.steelconstruction.org* or by an App available for download at the Apple App Store.

The search for suitable BCSA members is narrowed by applying the following filters:

### 1 Building or Bridgework
The database is divided at the top level into buildings and bridges. Other types of fabrication, such as masts or balconies, are sub categories of one of these two primary groups (see item 4).

### 2 Location
The BCSA member database may be searched by location. This may be a factor for smaller jobs, but not as significant on larger projects.

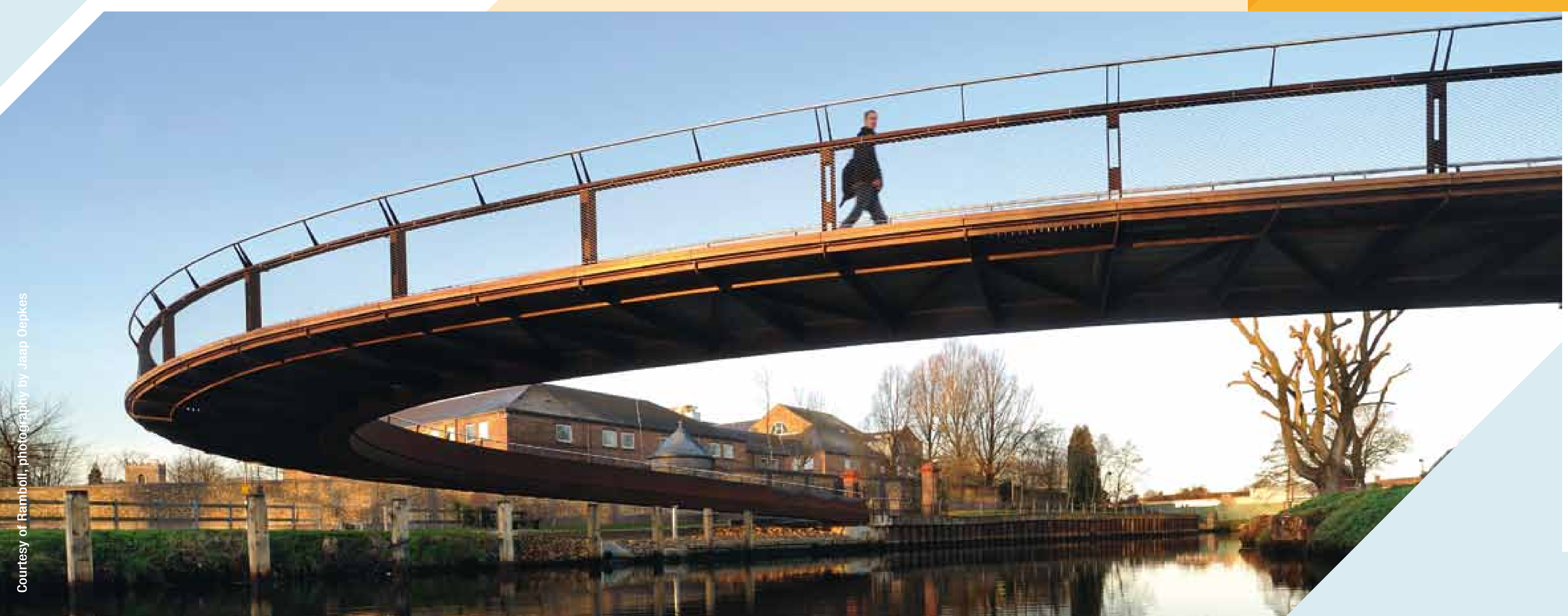
### 3 Size
The size of project that each member is capable to deliver is defined by the value of steelwork contract.

### 4 Type of work
There are 14 categories of building fabrication (ranging from heavy industrial plate work to fire escapes) and eight categories of bridgework (ranging from suspension bridges to gantries). The search allows multiple categories to be selected. The categories for both buildings and bridgework are shown opposite.

### 5 Certification
BCSA members operate to a number of accredited quality systems. The membership lists can be searched against one or more of these.

### 6 Sustainability Charter
Steel by its very nature is a sustainable solution as it is long lasting, infinitely recyclable and generates very little waste. BCSA members have the option to sign up to the Sustainability Charter, which is a commitment to report sustainability performance against a given list of criteria.

The BCSA assessment process is very rigorous. All member companies are visited and experienced assessors carry out checks on their capability and financial probity.


Courtesy of Ramboll, photography by Jaap Oepkes



# Making the right choice

**Each company only qualifies for inclusion on the BCSA's membership listings after being assessed by specialists who check financial and technical resources as well as track record and employed personnel; the assessments are carried out annually with a physical factory inspection every three years.**

## STEELWORK CONTRACTORS FOR BRIDGEWORK

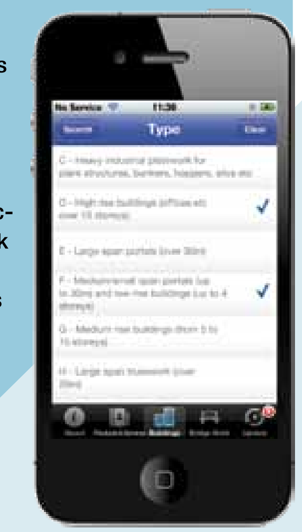
| | |
|---|---|
| FG | Footbridge and Sign gantries |
| PG | Bridges made principally from plate girders |
| TW | Bridges made principally from trusswork |
| CM | Cable-supported bridges and other major structures |
| BA | Bridges with stiffened complex platework |
| MB | Moving bridges |
| RF | Bridge refurbishment |
| AS | Ancillary structures in steel associated with bridges, footbridges or sign gantries |

## STEELWORK CONTRACTORS FOR BUILDINGS

| | |
|---|---|
| C | Heavy industrial platework for plant structures, bunkers, hoppers, silos etc. |
| D | High rise buildings |
| 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 joins a large part of the steelwork |
| 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 5,000 people) |
| Q | Specialist fabrication services |
| R | Refurbishment |
| S | Lighter fabrications including fire escapes, ladders and catwalks |

**Selecting a suitable steelwork contractor for type and scale of work can be done by visiting *www.steelconstruction.org* or using the new steelwork contractor App for smart phones. All of these options have search functions where various criteria, such as sustainability, can be selected.**

**Bridgework contractors can be found on the Register of Qualified Steelwork Contractors Scheme for Bridgeworks, which is administered by the BCSA and is open to any competent steelwork contractor with a fabrication facility in the EU. It was developed to fulfil the needs of the Highways Agency, all of whose contracts involving structural steelwork demand that a contractor is selected from this register.**



Sustainability in Steel Construction

The BCSA Steel Construction Sustainability Charter was developed to help identify companies that practice sustainable steel construction and are prepared to commit to continuously reviewing and improving their performance. Members are assessed against 12 criteria and can apply for different levels of recognition. "Member" level relates to six of the criteria being satisfied, Silver means nine, and Gold means all 12 criteria have been met.

The 12 criteria for sustainability charter membership:

1. A published sustainability policy (mandatory)
2. Monitor progress towards sustainability using specific management targets
3. A programme of involvement with their local community on social issues and with the steel construction community generally
4. An accredited Health and Safety management system to British Standard OHSAS 18001 or health and safety management as an integral part of a Quality Management System accredited to BS EN ISO 9001
5. Investors in People accreditation or a structured programme for personnel training, development and communication
6. A published equal opportunities policy
7. A published ethical trading policy
8. An accredited Environmental Management System to BS EN ISO 14001
9. Use of environmental impact assessment for process improvement
10. A policy to manage energy and vehicle fuel usage in the business
11. A policy to question whether suppliers have published sustainability policies
12. An accredited Quality Management System to BS EN ISO 9001

# 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.

| Company name | Tel | Contract Value |
|---|---|---|
| A C Bacon Engineering Ltd | 01953 850611 | Up to £2,000,000 |
| ACL Structures Ltd | 01258 456051 | Up to £2,000,000 |
| Adey Steel Ltd | 01509 556677 | Up to £4,000,000 |
| Adstone Construction Ltd | 01905 794561 | Up to £1,400,000 |
| Advanced Fabrications Poyle Ltd | 01753 531116 | Up to £800,000 |
| Alex Morton Contracts Ltd | 028 9269 2436 | Up to £400,000 |
| Angle Ring Company Ltd | 0121 557 7241 | Up to £1,400,000 |
| Apex Steel Structures Ltd | 01268 660828 | Up to £800,000 |
| Arromax Structures Ltd | 01623 747466 | Up to £800,000 |
| ASA Steel Structures Ltd | 01782 566366 | Up to £800,000* |
| ASD Westok Ltd | 0113 205 5270 | Up to £6,000,000 |
| ASME Engineering Ltd | 020 8966 7150 | Up to £800,000* |
| Atlas Ward Structures Ltd | 01944 710421 | Above £6,000,000 |
| Atlasco Constructional Engineers Ltd | 01782 564711 | Up to £2,000,000 |
| Austin-Divall Fabrications Ltd | 01903 721950 | Up to £200,000 |
| B&B Group Ltd | 01942 676770 | Up to £1,400,000 |
| B D Structures Ltd | 01942 817770 | Up to £400,000 |
| Ballykine Structural Engineers Ltd | 028 9756 2560 | Up to £1,400,000 |
| Barnshaw Section Benders Ltd | 01902 880848 | Up to £800,000 |
| BHC Ltd | 01555 840006 | Above £6,000,000 |
| Billington Structures Ltd | 01226 340666 | Above £6,000,000 |
| Border Steelwork Structures Ltd | 01228 548744 | Up to £3,000,000 |
| Bourne Construction Engineering Ltd | 01202 746666 | Above £6,000,000 |
| Briton Fabricators Ltd | 0115 963 2901 | Up to £3,000,000 |
| Cairnhill Structures Ltd | 01236 449393 | Up to £2,000,000 |
| Caunton Engineering Ltd | 01773 531111 | Up to £6,000,000 |
| Cleveland Bridge UK Ltd | 01325 381188 | Above £6,000,000 |
| CMF Ltd | 020 8844 0940 | Up to £6,000,000 |
| Cordell Group Ltd | 01642 452406 | Up to £3,000,000 |
| Coventry Construction Ltd | 024 7646 4484 | Up to £800,000 |
| D H Structures Ltd | 01785 246269 | Up to £40,000 |
| Discain Project Services Ltd | 01604 787276 | Up to £800,000 |
| Duggan Steel Ltd | 00 353 29 70072 | Up to £6,000,000 |
| ECS Engineering Services Ltd | 01773 860001 | Up to £2,000,000 |
| Elland Steel Structures Ltd | 01422 380262 | Up to £6,000,000 |
| EvadX Ltd | 01745 336413 | Up to £3,000,000 |
| Fisher Engineering Ltd | 028 6638 8521 | Above £6,000,000 |
| Fox Bros Engineering Ltd | 00 353 53 942 1677 | Up to £3,000,000 |
| Gorge Fabrications Ltd | 0121 522 5770 | Up to £800,000 |
| Graham Wood Structural Ltd | 01903 755991 | Up to £6,000,000 |
| Grays Engineering (Contracts) Ltd | 01375 372411 | Up to £100,000 |
| Gregg & Patterson (Engineers) Ltd | 028 9061 8131 | Up to £3,000,000 |
| H Young Structures Ltd | 01953 601881 | Up to £2,000,000 |
| Had Fab Ltd | 01875 611711 | Up to £2,000,000 |
| Hambleton Steel Ltd | 01748 810598 | Up to £6,000,000 |
| Harry Marsh (Engineers) Ltd | 0191 510 9797 | Up to £2,000,000 |
| Henry Smith (Constructional Engineers) Ltd | 01606 592121 | Up to £3,000,000 |
| Hescott Engineering Company Ltd | 01324 556610 | Up to £3,000,000 |
| Hillcrest Fabrications Ltd | 01283 212720 | Up to £400,000 |
| Hills of Shoeburyness Ltd | 01702 296321 | Up to £1,400,000 |
| J Robertson & Co Ltd | 01255 672855 | Up to £200,000 |
| James Killelea & Co Ltd | 01706 229411 | Up to £6,000,000* |
| Kiernan Structural Steel Ltd | 00 353 43 334 1445 | Up to £4,000,000 |
| Leach Structural Steelwork Ltd | 01995 640133 | Up to £2,000,000 |
| M Hasson & Sons Ltd | 028 2957 1281 | Up to £3,000,000 |
| M&S Engineering Ltd | 01461 40111 | Up to £1,400,000 |
| Mabey Bridge Ltd | 01291 623801 | Above £6,000,000 |
| Mackay Steelwork & Cladding Ltd | 01862 843910 | Up to £800,000 |
| Maldon Marine Ltd | 01621 859000 | Up to £1,400,000 |
| Mifflin Construction Ltd | 01568 613311 | Up to £3,000,000 |
| Newbridge Engineering Ltd | 01429 866722 | Up to £1,400,000 |
| Nusteel Structures Ltd | 01303 268112 | Up to £4,000,000 |
| On Site Services (Gravesend) Ltd | 01474 321552 | Up to £200,000 |
| Overdale Construction Services Ltd | 01656 729229 | Up to £400,000 |
| Paddy Wall & Sons | 00 353 51 420 515 | Up to £6,000,000 |
| Painter Brothers Ltd | 01432 374400 | Up to £6,000,000 |
| Pencro Structural Engineering Ltd | 028 9335 2886 | Up to £2,000,000 |
| Peter Marshall (Steel Stairs) Ltd | 0113 307 6730 | Up to £800,000 |
| PMS Fabrications Ltd | 01228 599090 | Up to £1,400,000 |
| REIDsteel | 01202 483333 | Up to £6,000,000 |
| Rippin Ltd | 01383 518610 | Up to £1,400,000 |
| Rowecord Engineering Ltd | 01633 250511 | Above £6,000,000 |
| S H Structures Ltd | 01977 681931 | Up to £3,000,000 |
| Severfield-Rowen Structures Ltd | 01845 577896 | Above £6,000,000 |
| Shipley Fabrications Ltd | 01400 251480 | Up to £1,400,000 |
| SIAC Butlers Steel Ltd | 00 353 57 862 3305 | Above £6,000,000 |
| SIAC Tetbury Steel Ltd | 01666 502792 | Up to £2,000,000 |
| Snashall Steel Fabrications Co Ltd | 01300 345588 | Up to £1,400,000 |
| South Durham Structures Ltd | 01388 777350 | Up to £800,000 |
| Temple Mill Fabrications Ltd | 01623 741720 | Up to £200,000 |
| The AA Group Ltd | 01695 50123 | Up to £4,000,000* |
| Traditional Structures Ltd | 01922 414172 | Up to £2,000,000 |
| Tubecon AESS | 01226 345261 | Above £6,000,000* |
| W & H Steel & Roofing Systems Ltd | 00 353 56 444 1855 | Up to £4,000,000 |
| W I G Engineering Ltd | 01869 320515 | Up to £200,000 |
| Walter Watson Ltd | 028 4377 8711 | Up to £6,000,000 |
| Watson Steel Structures Ltd | 01204 699999 | Above £6,000,000 |
| Westbury Park Engineering Ltd | 01373 825500 | Up to £800,000 |
| William Haley Engineering Ltd | 01278 760591 | Up to £2,000,000 |
| William Hare Ltd | 0161 609 0000 | Above £6,000,000 |

Details of BCSA membership and services can be obtained from
Gillian Mitchell MBE, Deputy Director General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7747 8121 Email: *gillian.mitchell@steelconstruction.org*

For a more detailed search, visit **www.steelconstruction.org**



# Steelwork contractors for bridgework

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.

| BCSA steelwork contractor member | Tel | Contract Value |
|---|---|---|
| B&B Bridges Ltd | 01942 676770 | Up to £1,400,000 |
| Briton Fabricators Ltd | 0115 963 2901 | Up to £3,000,000 |
| Cairnhill Structures Ltd | 01236 449393 | Up to £2,000,000 |
| Cleveland Bridge UK Ltd | 01325 381188 | Above £6,000,000 |
| Four-Tees Engineers Ltd | 01489 885899 | Up to £2,000,000 |
| Kiernan Structural Steel Ltd | 00 353 43 334 1445 | Up to £800,000 |
| Mabey Bridge Ltd | 01291 623801 | Above £6,000,000 |
| Nusteel Structures Ltd | 01303 268112 | Up to £4,000,000 |
| Painter Brothers Ltd | 01432 374400 | Up to £6.000,000 |
| Rowecord Engineering Ltd | 01633 250511 | Above £6,000,000 |
| S H Structures Ltd | 01977 681931 | Up to £3,000,000 |
| SIAC Butlers Steel Ltd | 00 353 57 862 3305 | Above £6,000,000 |
| TEMA Engineering Ltd | 029 2034 4556 | Up to £1,400,000* |
| Varley & Gulliver Ltd | 0121 773 2441 | Up to £4,000,000 |
| Watson Steel Structures Ltd | 01204 699999 | Above £6,000,000 |

| Non-BCSA member | Tel | Contract Value |
|---|---|---|
| ABC Bridges Ltd | 0845 0603222 | Up to £100,000 |
| A G Brown Ltd | 01592 630003 | Up to £400,000 |
| Allerton Steel Ltd | 01609 774471 | Up to £1,400,000 |
| Cimolai Spa | 01223 350876 | Above £6,000,000 |
| Concrete & Timber Services Ltd | 01484 606416 | Up to £800,000 |
| Donyal Engineering Ltd | 01207 270909 | Up to £1,400,000 |
| Francis & Lewis International Ltd | 01452 722200 | Up to £2,000,000 |
| Harland & Wolff Heavy Industries Ltd | 028 9045 8456 | Up to £2,000,000 |
| Hollandia BV | 00 31 180 540540 | Above £6,000,000 |
| Interserve Construction Ltd | 0121 344 4888 | Above £6,000,000* |
| Interserve Construction Ltd | 020 8311 5500 | Above £6,000,000* |
| Millar Callaghan Engineering Services Ltd | 01294 217711 | Up to £800,000 |
| P C Richardson & Co (Middlesbrough) Ltd | 01642 714791 | Up to £3,000,000 |
| The Lanarkshire Welding Company Ltd | 01698 264271 | Up to £2,000,000 |

# Associate Members

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

| Company name | Tel | Business type |
|---|---|---|
| AceCad Software Ltd | 01332 545800 | Software |
| Albion Sections Ltd | 0121 553 1877 | Components |
| Andrews Fasteners Ltd | 0113 246 9992 | Fasteners |
| ArcelorMittal Distribution – Birkenhead | 0151 647 4221 | Stockholder |
| ArcelorMittal Distribution – Bristol | 01454 311442 | Stockholder |
| ArcelorMittal Distribution – South Wales | 01633 627890 | Stockholder |
| ArcelorMittal Distribution – Scunthorpe | 01724 810810 | Stockholder |
| ASD metal services | 0113 254 0711 | Fasteners |
| Austin Trumanns Steel Ltd | 0161 866 0266 | Stockholder |
| Ayrshire Metal Products (Daventry) Ltd | 01327 300990 | Components |
| BAPP Group Ltd | 01226 383824 | Fasteners |
| Barnshaw Plate Bending Centre Ltd | 0161 320 9696 | Components |
| Barrett Steel Ltd | 01274 682281 | Stockholder |
| BW Industries Ltd | 01262 400088 | Components |
| Cellbeam Ltd | 01937 840600 | Components |
| Cellshield Ltd | 01937 840600 | Safety |
| CMC (UK) Ltd | 029 2089 5260 | Stockholder |
| Composite Profiles UK Ltd | 01202 659237 | Components |
| Computer Services Consultants (UK) Ltd | 0113 239 3000 | Software |
| Cooper & Turner Ltd | 0114 256 0057 | Fasteners |
| Cutmaster Machines UK Ltd | 01226 707865 | Machinery |
| Daver Steels Ltd | 0114 261 1999 | Components |
| Development Design Detailing Services Ltd | 01204 396606 | Design |
| Easi-edge Ltd | 01777 870901 | Safety |
| Fabsec Ltd | 0845 094 2530 | Components |
| FabTrol Systems UK Ltd | 01274 590865 | Software |
| Ficep (UK) Ltd | 01924 223530 | Machinery |
| FLI Structures | 01452 722200 | Components |
| Forward Protective Coatings Ltd | 01623 748323 | Coatings |
| Graitec UK Ltd | 0844 543 888 | Software |
| Hadley Rolled Products Ltd | 0121 555 1342 | Components |
| Hempel UK Ltd | 01633 874024 | Coatings |
| Hi-Span Ltd | 01953 603081 | Components |
| Highland Metals Ltd | 01343 548855 | Coatings |
| Hilti (GB) Ltd | 0800 886100 | Fasteners |
| International Paint Ltd | 0191 469 6111 | Coatings |
| Jack Tighe Ltd | 01302 880360 | Coatings |
| Jamestown Cladding and Profiling | 00 353 45 434288 | Components |
| Jotun Paints (Europe) Ltd | 01724 400000 | Coatings |
| Kaltenbach Ltd | 01234 213201 | Machinery |
| Kingspan Structural Products | 01944 712000 | Components |
| Leighs Paints | 01204 521771 | Coatings |
| Lindapter International | 01274 521444 | Fasteners |
| Metsec plc | 0121 601 6000 | Components |
| MSW | 0115 946 2316 | Components |
| National Tube Stockholders Ltd | 01845 577440 | Stockholder |
| Northern Steel Decking Ltd | 01909 550054 | Components |
| John Parker & Sons Ltd | 01227 783200 | Stockholder |
| Peddinghaus Corporation UK Ltd | 01952 200377 | Machinery |
| Peddinghaus Corporation UK Ltd | 00 353 87 2577 884 | Machinery |
| PPG Performance Coatings UK Ltd | 01773 814520 | Coatings |
| Prodeck-Fixing Ltd | 01278 780586 | Components |
| Rainham Steel Co Ltd | 01708 522311 | Stockholder |
| Richard Lees Steel Decking Ltd | 01335 300999 | Components |
| Structural Metal Decks Ltd | 01202 718898 | Components |
| Studwelders Composite Floor Decks Ltd | 01291 626048 | Components |
| Tata Steel | 01724 404040 | Steelmaker |
| Tata Steel Distribution (UK & Ireland) | 01902 484100 | Stockholder |
| Tata Steel Service Centres Ireland | 028 9266 0747 | Stockholder |
| Tata Steel Service Centre Dublin | 00 353 1 405 0300 | Stockholder |
| Tata Steel Tubes | 01536 402121 | Steelmaker |
| Tata Steel UK Panels & Profiles | 0845 308 8330 | Components |
| Tekla (UK) Ltd | 0113 307 1200 | Software |
| Tension Control Bolts Ltd | 01948 667700 | Fasteners |
| Wedge Group Galvanizing Ltd | 01909 486384 | Coatings |